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JPRS-ELS-87-056
31 DECEMBER 1987

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ADVANCED MATERIALS

French Magnetic Forming Conference Reviewed

3698A002 Paris CPE BULLETIN in French Jul 87 p 8

[Article signed M.B.: "Magnetic Forming"]

[Text] The SEE [Society of Electrical and Electronics Engineers] organized two study days on magnetic forming in Grenoble on 27-28 November 1986 with the participation of some 60 research scientists and industrialists. Magnetic forming is a recent process for deforming metallic materials, consisting in the rapid application of an intense magnetic field. The part to be formed is subjected to the interactive force between the field and the induced currents and is forced under pressure onto a matrix or other part to be set.

Some systems used in magnetic forming were described; among them a project for high-power pulse-type feeding (10 MJ within 10 microseconds instead of the current 100 kJ), using a rotating machine for storing the energy before being released. This generator can be quickly built and used commercially within 3 to 5 years, but this has not yet been accomplished in France (it is said to exist in the United States and the Soviet Union).

Finally, a few industrial applications were presented by CEA [Atomic Energy Commission], CNRS [National Center for Scientific Research], CETIM [Technical Center for Mechanical Industries], Barras Provence, and IPARI, the Budapest technology institute. These are generally expensive in terms of equipment and operation (a coil can be destroyed) and are therefore limited to specific instances when magnetic forming is indispensable. The coil is placed either inside the part (expansion) or outside (compression) or on its side (projection against a matrix). Other related techniques were also exhibited: magnetic welding of metals and magnetic compacting of powders, both resulting in genuine metallic bonds.

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ONERA Structures for Technology, Know-How Transfers Overviewed

3698A001 Paris L'USINE NOUVELLE in French 27 Aug 87pp 24-25

[Article by Marc Chabreuil: "ONERA Implements Its Know-How", first paragraph is L'USINE NOUVELLE introduction]

[Text] An aerospace research agency, ONERA [National Office for Aerospace Studies and Research] helps many small- and medium-sized firms to benefit from its technological knowledge. Besides granting licenses, it trains engineers, supplies customers, creates manufacturing links....

An electrostatic filter for hot gases under high pressure, now under development; a capacitive measuring bridge fitted on several machine tools at Michelin; an ultrasound flowmeter on Liquide Air delivery trucks.... On the face of it these products have nothing in common. Nonetheless, all three (and many more) are the outcome of aerospace research. Better still, they are manufactured under license from ONERA by firms, often small, which do not belong to this sector. Taken from 45 such cases, these examples illustrate the office's technology transfer and implementation efforts over nearly 20 years.

Admittedly, this activity remains marginal as far as ONERA is concerned. "Because the majority of transferable products are sophisticated measuring instruments that are ahead of demand. They are oddities for which the world market is limited and not readily accessible to small- and medium-sized manufacturers," acknowledges Robert Latournerie, director of economic and financial affairs and research implementation at ONERA. Nevertheless, this agency receives Fr 1 million per year in royalties, which corresponds to an estimated turnover of Fr 30 million. And every year six or seven new contracts are concluded. However, not all of them have a successful outcome due to a lack of market research. These figures are less modest than they seem when it is realized that 99 percent of the office's research concerns aeronautics, space, or armaments and that a quarter of the patents applied for result in granting of a license.

To achieve this result, ONERA has drawn up an original policy with the aim of making its researchers and engineers aware of the importance of implementation. Any inventor who wishes to apply for a patent has to submit an explanatory report in layman's terms to a committee highlighting the technology aspects of the discovery and "mentioning possible markets outside the aerospace sector. "At the end of it all is a premium of between Fr 1,000 and Fr 10,000 for 6 years. If a license is sold, the holder of the patent will receive 6 percent of the funds. "Moreover, this percentage is soon to be increased," affirms Robert Latournerie. The result is that in two out of three cases the initiative for a technology transfer comes from one of the agency's researchers.

ONERA is also making serious efforts to help business. Initially, when the agreement is signed the license fee is nominal (Fr 10,000) and the royalty percentage low (between 5 and 10 percent). Above all, the office helps the manufacturer, free of charge, to acquire the necessary know-how to move from the laboratory to the manufacturing phase. Not by reassigning personnel, but by letting the licensee's own staff work on ONERA premises. In this way, Metravib's research-and-development service subsidiary sent three of its engineers to Chatillon for 18 months "where they learned ONERA's methods and used its equipment," explained Pierre Schindler, director of development. Now that they are back in the firm, they are preparing to manufacture thin film sensors.

Production will start in one year. The same thing happened at Ecopol, a medium-sized firm with a staff of 35 which reassigned 6 engineers and 4 technicians to learn the secrets of a charge accumulation injector and controller. However, its assistant general manager, Philippe Guillet, is more cautious: "ONERA's research workers are not very interested in the predevelopment phase of the manufacturing process, and they are hardly ready to devote time to it. The result is a not inconsiderable loss of knowledge."

In fact the success of a technology transfer depends on the relationship which develops between the inventor and the licensee. At Fogale, a small three-person firm, they claim that on the contrary the inventor of the capacitive measuring bridge has become a real friend: "A frequent visitor to the firm, he has helped us to develop spin-off products."

In every case the move from prototype to product takes a long time. And, most of the time, further research is necessary to develop versions better suited to the market. At Fogale, no less than 3 years were needed to get to this point. The system offered today is smaller, less sensitive and, above all, can be used for the contact-free measurment of dimensions, as well as for measuring humidity. For its part, Metravib's research-and-development service is now researhing applications for thin film sensors. Originally intended for measuring hydrodynamic fields (sonars, ship propellers, etc.), they are to be adapted for use in measuring the wear and tear on components subject to flow effects. Similar efforts are being made at Ecopol which, with the help of ANVAR [National Agency for the Implementation of Research] and thanks to a Cifre [not further identified] contract—but principally on a self-financing basis—has developed an electrostatic neutralizer which prevents dust buildup on products, notably plastic. A use could be found for this apparatus in the movement of powders by air, which is more economical than by nitrogen. "This is an activity which is difficult to maintain on a full-time basis. The cost of financing the pilot production run is greater than the demand," laments Philippe Guillet. No less discouraged by all that, he is aiming at developing an electrostatic filter which will purify, far more rapidly than at present, gases under high pressure and at very high temperatures (up to 600 degrees Celcius). This project dates back to 1981; dormant for a short time, it now has the benefit of support from ONERA and Serete (which owns 75 percent of the firm), financial aid from the EEC; and the presence of a German industrial partner. Trials should begin this year.

Marketing a product manufactured under an ONERA license is not always such hard work. On several occasions ONERA has offered manufacturers both a license and a clientele. For example, since ONERA had too many orders for accelerator switches and thin film sensors, it offered licenses for them to Sfena and Metravib. In certain cases it even organizes manufacturing links. Sopra, for example, a 60-person firm which manufactures the DRASC (optical measuring of gas concentration and temperature), was teamed up with Bertin, which has developed a mobile demonstrator and is offering a range of services (implementation, creation of interfaces, interpretation of results, etc.). Similarly, Ecopol (non-aeronautical applications) is sharing the Coras antistatic coating tester with the English firm Chelton (aeronautics market).

Most of the products originating from ONERA are exported: to Switzerland and England (Fogale), to the United States, Sweden and Germany (Ecopol), to Brazil (Sfena).... However, several licenses have also directly sold licenses abroad. Today, due to a lack of domestic customers, Ecopol's electrostatic neutralizer is being manufactured by an American company. Tomorrow, the atomizer originally intended for cooling exhausters (Bertin) will probably be manufactured in Japan.... ONERA itself is selling its thermal processing method for nickel superalloys to the American firm Cannon-Muskegon, but for a sizeable return: the granting of a license for the material to a French manufacturer chosen by ONERA.

These 45 licensing agreements are only the visible tip of the implemenation iceberg. To them may be added 3 research agreements with manufacturers (CGE, Pont-a-Mousson, Lafarge-Coppee, Saint-Gobain, Cegedur, Pechiney, L'Air Liquide, etc.) and 12 agreements for joint proprietorship of patents (Alsthom, Imphy, Crouzet, etc.). "Above all, the major manufacturers in the field (Aerospatiale, SNECMA, Matra, Dassault, SEP...), which are in permanent contact with ONERA, substantially contribute to the process of transferring results to firms in the "outer circle," i.e., manufacturers of equipment for aeronautical and military use, aeronautics subcontractors, and (specialized) subsidiaries of the major firms," asserts Robert Latournerie. This activity cannot be quantified and is beyond ONERA's reach.

25065

AUTOMOTIVE INDUSTRY

Italy's R&D In Car Technology

36980069a Turin ATA-INGEGNERIA AUTOMOTORISTICA in Italian Jul 87 pp458-461

[Speech by G Garuzzo, president and director general of IVECO-FIAT, opening the meeting organized by the CNR and ATA on occasion of the 10th Industrial and Commercial Vehicles Salon in Turin; date not given]

[Text] This day is the occasion of the opening of the 10th Industrial and Commercial Vehicles Salon in Turin, where IVECO finds itself "playing at home" (even though, as a vocation from the beginning our presence as an industrial activity, research included, in many countries has caused us to regard Europe as our "domestic" market).

A brief look together at the expansion, the objectives, the conditions of this coinvolvement can focus the term "research" in the most current acceptance.

Today, an industry is no longer simply attracted by research out of a generic interest in experimental or patented products; it is indissolubly linked by the simple fact of operating in a system of technological interdependences and information integration that constantly brings the industrial world closer to a "world village," to use the expression of a well-known Canadian expert in communications systems, Marshall McLuhan.

The history of our enterprise is a demonstration of this. IVECO has grown through ever-broader levels of integration, not only of market, but of technological and industrial culture; and this research also continues to act as a stimulus toward more advanced levels of integration.

IVECO's research and development activity is international, with centers located in five European countries, and it is also integrated into the FIAT research system, in the context of which the FIAT Research Center is the most advanced component.

Furthermore, in order to make more effective the relationship with the major innovations underway in the engineering context, a specific advanced engineering sector has been established, which, maintaining a dialogue with the research centers, can have as its principal purpose long-term innovation, freed from the development needs for the short and medium term.

For a product such as industrial vehicles, innovation is normally "incremental": this means that each new product model differs from the preceding by a series of innovations spread through all the product's components, planning techniques, and product technologies; sometimes small if the various innovative techniques are compared one by one, but always rather complex when taken as a whole.

Another characteristic element of the innovation process, for an enterprise that simultaneously produces various models over the entire range of market segments, concerns the necessity to combine the innovative changes for a new model with the normal activities of production and of updating other models.

Individual radical innovations on a given model, both on the product and production process levels, are thus difficult to implement, not so much because of the risk of new things, as of the constraints due to the entire production activity underway.

Under these conditions, the research activity would have mainly "trouble-shooting" tasks, and would be markedly shifted downward toward the development and activities of preindustrialization.

Considering these reasons of industrial structure of the sector, today IVECO is oriented toward objectives of in-depth innovation, "passing from planning of individual products to planning of systems."

This objective is even more timely in that it simultaneously offers exceptional technological opportunities for modernization. These opportunities derive from the developments in the past few years in new technologies (materials, electronics), new theoretical-experiment bodies of knowledge, and applications of the information technologies.

The research activity can thus be called on to carry out not so much a support or checking task, but rather one of exploration of ideas and new solutions, of compatibility among various innovative objectives, of discovering original solutions in design of components, subsystems, and architectonic product configurations.

In the next 3 years, IVECO will devote 2 trillion lira to investments in research and to innovation investment.

Among the main objectives of this commitment are: 1) A plan for integrated involvement over the entire range; 2) further automation of production; and 3) technological innovation of products.

1. The integrated involvement over the entire range can be defined as a product plan aimed at a world market, by developing a system of extremely diversified vehicles, but based as far as possible on common components, designing the specific components so they can be processed in flexible installations. In order to achieve these objectives, a number of actions were initiated involving both the product technology and process technology.

One of the main problems that industrial vehicle producers must tackle is that of reconciling the needs for personalization that characterize this market with those of competitiveness in unit costs that only mass production can guarantee. One of the big advantages of systems engineering, through modularity of components, is precisely that of making supply more flexible, along with standardization. This means putting the preconditions for proceeding with a product renewal on a systematic basis, consolidating the various subgroups as far as possible. To this end, it is fundamental to use computer-assisted planning techniques and to develop data banks to facilitate research of the modular elements.

The benefits are not limited to competitiveness of the product linked to initial cost, but also reduction of operation cost.

2. Automation of production should be coherent with reduced daily production volumes, and should thus be extremely flexible to adapt to specific and ad hoc market

demands for very heterogeneous and differentiated models. The implication is that the new production processes as well, and not only the range of products, will be totally innovative.

It is the objective of the general strategy of the manufacturing process to integrate, through a real-time information system, the various functions involved in the industrial process.

In this way, the key points of the entire industrial process can be integrated among themselves: design of the product, planning of production, accumulation of supplies, control of the tools, of energy, materials, control of production, and analysis of production cycles.

It is necessary to remember that many capabilities of automation already utilized in auto production represent a challenge for the industrial vehicle sector in view of the smaller production volumes.

3. The third point in the plan concerns technological innovation of each element of the products to be carried out on all fronts: from that of materials (ceramic materials for higher engine output, and composite materials to reduce the weight of structural parts), to that of micro-electronics (which enable solving conflicting needs such as improved output from engines and adherence to the severe regulations on emissions, by seeking the best compromise under any condition of engine load).

In respect to engines, the primary objective of the innovations is reduction of fuel consumption and emissions.

While in the 1970's—due to the energy crisis—the majority of attention was devoted to the first aspect, today the second problem has gained prominence, and the producers are seeking solutions to it that do not deprive the customer of the results already achieved in terms of energy solving.

IVECO, like other European manufacturers, developed toward the end of the 1970's and the beginning of the 1980's engines with emissions reduced, compared to the preceding situation, by 40-50 percent, and now produces a range of engines with emissions lower than the limits recently defeined by the European Community that will become compulsory in 1988.

At this point, further reductions in emissions, considering those really necessary in the general ecological context, require an overall approach to the problem, and presuppose acceptance by customers of some penalties in terms of performance, consumption and price.

Given the interdependence of these aspects, IVECO is working on the processes of combustion and supply—to reduce the gas emissions—through an approach today enabled by the technologies of computer-assisted design; and for solid emissions through studies on certain particle "traps."

The solutions in regard to diesel engine emissions all fall within the scope of very advanced technologies.

Good will actions are not enough: it is necessary to devote technical resources and substantial management.

The techniques for reduction of emissions involve mainly two aspects: control of combustion and regulation of feed of air and fuel.

In regard to "combustion," complex theoretical-experimental studies are underway to learn even better the mechanisms of formation of pollutants, and to determine the most effective methods for limiting them.

In this context, various types of combustion chambers are being developed whose use involves also resort to material technologies in process of development.

Another important factor is "feed" of air, which is involving extensive use of boost-feed, increasingly combined with intercooling. A further key factor in emissions control is the injection apparatus, which is undergoing significant developments, both in regard to increasing injection velocity and in electronic regulation of the amounts and advance to insure optimum readings in the various operating phases.

Finally, it is worth having an adiabatic reading of certain parts of the engine, for example, the exhaust pipes, so as to keep the gases hot and obtain a postcombustion effect along with a greater energy flow in turbine, and hence better output of the latter.

The fall-out in the product of such techniques will naturally be gradual, and will depend also on the responsiveness of the European industry in components, whose availability (injection apparatus, and turboblowers, particularly of innovative materials, etc.) is crucial.

In a general way, it should be noted that some techniques (combustion chambers; electronic regulators of injection and quantities; and turboblowers) can be available toward the end of the 1980's, while other solutions can be achieved in the early 1990's.

In conclusion, it should be noted that the current development trends will certainly guarantee the diesel engine, which today offers high energy output, and also the possibility of having low exhaust emissions.

In the area of diesel alternatives, those proposed thus far to solve, for example, the problem of pollution by urban buses, using methanol, methane, dual fuel liquefied

petroleum gas (LPG), or hybrid electric vehicles, to this point appear more as demonstration efforts rather than thought-out industrial choices.

There exists among the manufacturers and in the technical and scientific circles the profound conviction that, along with the improvement of combustion systems, "the technology of the trap represents the real means to reduce the particulate and thus the smoke of urban buses." In fact, this does not require a revolution of the "diesel system" at both the industry and operating level, but is a development that complements and is integrated with a well-known technology retaining advantages in terms of reduced fuel consumption and high performance, particularly when combined with boost-feeding and intercooling.

There are still some problems with reliability of the trap apparatus, particularly that of regeneration; on the other hand, the volume of studies underway on a worldwide scale is a guarantee of reaching a solution, for priority application to the urban bus.

In this sector, IVECI is developing particle trap solutions based on its own ideas, or in cooperation with European and American component producers.

Tests are underway in the IVECO laboratories in Italy and Germany to evaluate, among other things, a solution for buses based on a monolithic ceramic filter equipped with an independent regeneration system. The laboratories have already demonstrated complete elimination of bus exhaust smoke during the initial tests.

Cooperation with public research institutions on all these topics is envisaged, such as that already established with the Naples Engine Institute of the National Research Council, on the "clean engine" project we proposed in the "Transport 2 Final Plan."

However, reduction of consumption remains a primary need, which must be tackled from all possible angles.

Along with improvement of effective engine output, there are also efforts devoted to other vehicle components aimed at lowering the aerodynamic drag coefficient, optimizing the linkage between engine, transmission and axle and reducing the rolling resistance, and lightening the vehicle by replacing traditional materials with latest-generation polymer and composite materials.

Another field of important innovation is in built-in electronics, both electronics assigned to controlling the power train, and the systems for driver information, a subject that will be fully discussed in the reports of the steering committee of the Prometheus Project.

Alerting the driver to "hostile" environment factors (temperature, acceleration and vibration, and electromagnetic disturbances) requires development both of sensors and new-type electronic control panels, as well as a system architecture that combines reliability and quality with economy.

Today, experiments are underway with systems of communication from the vehicle to the particular operations center by satellite, with the obvious purpose of making the means of transportation increasingly productive.

From a performance point of view, we are called on for very high productivity.

In addition to modern features and specialization of vehicles, various factors can contribute to this: among these are understanding of the infrastructures, the technological and information support structures, and even the organization models of logistics and transportation management.

Thus, the entire process of rationalization of transport systems has a role that involves not just the manufacturers, and that, moreover,requires a thorough updating of methodology and cooperation between manufacturing enterprises and public research organs.

It requires a jump forweard in the culture of researchers, both public and industrial, remembering that the economic objectives of the innovation must be considered among the guiding criteria in applied research.

This orientation must govern the harmonization of this same applied research, removing the obstacles of an institutional nature that have thus far hampered exchange between universities and factories.

It should also be kept in mind that the support that the public structures can give a company in terms of research does not stop within the company itself, but contributes to keeping the entire national sector competitive.

IVECO today purchases 2.2 trillion lira worth of components per year. In order to produce a product in conformance with European standards, it is necessary to buy also critical components abroad: I mention the example of injection pumps, but I could add many others.

There is no doubt that for a transformation economy like the Italian, subject to constant pressure of tecnological change, it is desirable to extend control of the technologies of critical components wherever possible.

This necessity brings us back to the concept of the industrial vehicle as a transport system-product, which combines very many technological innovations, developed in various knowledge and technological fields. It is clear that the function of the system-product is to set

objectives and give directions to the new knowledges and the new technological sectors on the basis of the overall understanding of the vehicle system.

Thus, it is necessary to operate in an organic form between the system specialist and the scientific-technological realm that results in product innovation.

In 1986, the Ministry of Industry prize was awarded to IVECO. The prize was established to highlight the most advanced programs in technological innovation, giving access to the benefits of the financing fund established for the purpose by the Ministry of Industry.

This recognition makes us feel that our exceptional effort of investments research and innovation investments is shared.

Our country must intensify the commitment in this direction, so that Italian industry can maintain its level of competitiveness also in the innovation sector.

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FIAT's Advance In Automatic Transmissions

36980075a Paris L'USINE NOUVELLE in French 24 Sep 87 p 62

[Article by Michel Vilnat: "Revolution in Gearboxes: Thanks to the Metal Belt, a New Generation of Automatic Gearboxes Is Appearing on the Market"]

[Text] At the beginning of October, the FIAT group, the largest European automobile manufacturer, will launch the Uno Selecta in France, the first car equipped with a continuously variable gearbox using a metal belt. It will precede by a few weeks the Fiestamatic of Ford, which also participated in its design.

This system of continuous variation, half as expensive as a four-ratio automatic gearbox, dispenses with gears. A belt strong enough to survive any tests turns between two conical pulleys whose diameter varies progressively with speed. "Its development took a long time, because it was necessary to reconcile contradictory demands: elasticity and good resistance to traction, lubrication, and absence of slipping...," explained Andre Balsamo, the man in charge of tests on automatic gearboxes for the FIAT group.

This belt is formed of two bands composed of 10 layers of Maraging steel of high resistance (172 kilograms per square millimeter), each 0.18 millimeters thick, which bind 300 metal pieces. The latter have a dual role: to keep the bands (that transmit the force) centered and to move without slipping on the surfaces of the two pulleys.

Most of the problems were related to industrialization, which for the present is being carried out at Van Doorne, at Tilburg (near Amsterdam). For example, the layer strips are cut from Maraging sheet steel, then welded, before being nested one inside the other. The ring thus formed is stretched to the desired dimensions and undergoes a series of complex thermal treatments. Also, the calibration of the 300 centering pieces is very precise; their grinding is essential, also their surface condition, which determines the rubbing coefficient of the belts-pulleys. The final mounting is carried out on a special machine that selects and measures them. The computer then selects the last 15 in respect to thickness (the 285 others being already in place) in order to adjust them very precisely according to the length of the bands.

Though the belt was the most delicate part to develop, the pulleys control was the subject of extensive research to relate their movement to the accelerator. If the driver wants rapid acceleration, the system must favor higher engine turnover over consumption; by contrast, under more "gentle" driving, the gearbox adapts the ratio to the most economical engine speed.

This device provides variation without jerks, while retaining the engine brake effect (unlike the DAF!), and over a much broader range than a traditional gearbox. Result: increased driving comfort, and particularly a drop in fuel consumption.

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FIAT/ENEA's Chamber For Testing Auto Electronics

36980069b Rome NOTIZIARIO DELL'ENEA in Italian Sep 87 p 66

[Text] On 28 July, at the FIAT Research Center of Orbassano, was demonstrated the "anechoic chamber" developed by the FIAT Research Center and ENEA, the largest experimental equipment in Europe for study of reliability of electronic systems for civilian vehicles (22 by 11 by 6.4 meters).

The initiative, which is in the context of the activity provided for in the framework agreement between FIAT and ENEA (signed in June 1984), was explained by the president of the FIAT Research Center, Rossi; by the director general of ENEA, Pistella; and by the director of administration for the Botta agency.

The "anechoic chamber," named the Galileo Ferraris Room, enables reproducing real electromagnetic field conditions (such as those produced by radio transmitters, radar installations, etc.) with the purpose of checking the operation of the sophisticated electronic equipment now installed on a large scale in automobiles (such as ignition, check-control, braking system), which can be affected when it passes through such fields yet which needs to have maximum efficiency.

The reliability tests of industrial components are one of the sectors of promotion and spreading of technological innovation by ENEA toward the national industry, above all toward small- and medium-size industry. To this end, the body cooperated with the FIAT Research Center through technical and financial support in developing the "anechoic chamber," and is participating in use of the experimental assets on a 40-percent of time basis, and in research and experimental activities of common interest to be developed in the next 3 years.

The Galileo Ferraris "anechoic chamber" is the largest in Europe for civilian applications, and was designed entirely by technicians of the FIAT Research Center in cooperation with the major companies in the sector.

The two most important characteristics of a chamber for electromagnetic compatibility tests are its shielding power and its "anechoic" rating. In order to achieve a good shielding power, and at the same time to prevent propagation outside the chamber of the high-intensity electromagnetic fields generated inside, it was necessary to create a very large "Faraday cage" composed of copper sheets, by which the environment was completely covered. This system guarantees electrical continuity and prevents any escape to the outside or possibility of interference.

In order to simulate normal environmental conditions in a confined volume, it was on the other hand necessary to reduce as far as possible the reflection fields of the metallic structure enclosing the room: in short, to eliminate the echoes and hence increase the anechoic level. The technique used was to line all the surfaces with pyramids of expanded polyurethane, containing conductive fibers, so as to dissipate the energy associated with the electromagnetic waves.

In this way, a "calm zone" was achieved in the chamber simulating the conditions of open space.

The chamber was equipped with a round table with a roller test-bench to simulate as well as possible real driving conditions and to orient the vehicle with respect to the antenna generating the electromagnetic field. A sophisticated automatic observation and measuring device, operated by a computer, enables observation of malfunctions of the electronic systems in the frequency range from 10 kHz to 1 GHz with field intensity of up to 200 V/m.

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BIOTECHNOLOGY

New Biotech Companies in UK

3698A004 Paris CPE BULLETIN in French Jul 87pp 21-22

[Article signed R.B.]

[Text] There are some 20 new biotech companies in the UK at this time. None of them is listed on a stock exchange, in contrast to several hundred companies in the United States. One of these companies is in a position to stand up to competition: Celltech with sales of $11 million (95 percent exports). Investments in the United States in this field are much higher. For instance, Cetus Corporation alone has succeeded in raising more capital than the total invested in all British "start-ups" since their creation.

Great Britain is known for the high level of its research; the difficulties to overcome are essentially tied to production and marketing. It is not a question of turning scientists into businessmen, but of improving their alliances with business circles. It should be pointed out that there are increasing connections between companies and universities. In view of government budgetary restrictions, researchers have been forced to negotiate contracts with industry more frequently than in the past. Furthermore, the British Government has adopted a policy of encouragement to facilitate associations between major companies and university laboratories. The LINK program should permit financing of finished projects whose results have some chance of succeeding on the international market. However, U.S. financial analysts do not believe that the club formula, which associates several firms in one R&D coalition, is a solution to the problem of having exclusive industrial property rights. In this environment the smallest companies, without their own R&D infrastructure, appear vulnerable. For instance, Grand Metropolitain's decision to withdraw from this field forces Biokit and Bio Catalyst, which had been sponsored by the group, to search—not without difficulty—for new buyers.

Meanwhile, there is a new vitality witnessed in the major British chemical, pharmaceutical, and agro-food companies which are active in biotechnology. ICI has created a multidisciplinary research center west of London. It plans to buy the Stauffer Chemicals agrochemical group for 1 billion pounds and intends to acquire a share in SES (European Seeds Company). In the health field and in view of the delays in introducing Genentech's "TPA" to the U.S. market, Beecham is preserving its position to market eminase, a competitive specialty, while Wellcome Foundation (Genetic Institute) is contesting the patents taken out on TPA by the California company.

25053

COMPUTERS

British ALVEY Project Examined

3698A324 Amsterdam COMPUTABLE in Dutch 14 Aug 87 p 19

[Unattributed article: "Flagship Developing New Technologies—British Authorities and Industry Financing Research"; first paragraph is COMPUTABLE introduction]

[Text] At a cost of 15.5 million pounds, the Flagship project is the most important project in the British Alvey research program to be funded by the government and

industry. Flagship's goal is to combine three closely related technologies, a target that can best be illustrated by the riddle of the farmer who must take a wolf, a goat, and a cabbage across the river in his boat. Substitute "declarative languages" for the goat, "parallel architecture" for the wolf, "program transformation" for the cabbage, and the problems involved become obvious.

The farmer's problem is solved as soon as he has safely conveyed both animals and the cabbage to the other bank, but an overburdened research program is continuously in danger of sinking. The question as to which passenger is responsible for the excess weight is consequently irrelevant. The solution to the riddle is that the goat must be kept on the move to prevent it from eating the cabbage and to make sure it is not eaten by the wolf. The three parts of the Flagship project are intricately linked, yet the key to its success will be the declarative languages.

Expressive and Compact

Activities at the Imperial College in London have always focused on the development of languages. This was the case for their own ALICE [Applicative Language Idealized Computing Engine] project, now officially concluded, as well as for the major decentralized Flagship project, which succeeded ALICE. Declarative languages are expressive, compact, and understandable, provided the right language is used in the correct manner. However, these were not the reasons that led to the development of such languages.

The importance of declarative languages rather lies in the multiple possibilities as a basis for parallel processing and as "raw material" for future software manufacturers equipped with powerful resources for program transformation. As opposed to conventional Von Neumann-type languages, declarative languages are not time-bound. Consequently, they allow the introduction of various parallel evaluation strategies and machine-supported transformations through which the appearance and performance of the code are altered but the final result remains unchanged.

Language development in the Flagship project is structured around the functional language Hope, initially developed at the University of Edinburgh, and the logical programming language Parlog, related to Prolog, especially designed for parallel processing. Since the number of languages and the various target machines are bound to increase, a machine-independent interlanguage is used in this project as well as in other Alvey projects. The language in question is DACTL (Declarative Alvey Compiler Target Language), which was developed at the University of East Anglia and is currently gaining recognition in other countries.

Actually, contacts have already been established between the developers of DACTL and researchers at the University of Nijmegen.

Cooperation

In addition to the three aforementioned fields, Flagship is also concerned with system architecture, thereby attempting to create a reliable, safe, transparent, and efficient work environment for various users, various applications, and large amounts of data that can be accessed by a number of users. The PISA (Persistent Information Space Architecture) project of the universities of Glasgow and St. Andrews plays a major part in this context. Flagship could probably survive without this assistance but not if the technology is to stand a chance outside the sheltered environment of the research laboratory. Especially ICL, which controls the consortium, intends to try hard to introduce the technology developed inside the laboratory to "the cruel outside world."

Another major participant in this project is the Univeristy of Manchester, particularly Dr Ian Watson, who has acquired a great deal of experience in parallel processing in the Manchester dataflow project. The relevance of Plessey, the other industrial partner is somewhat overshadowed by ICL's active part.

"The main objective of both ALICE and Flagship," says professor John Darlington of the Imperial College, "is to make declarative languages suitable to support the development of new applications and to build up integrated systems around these languages with the help of programming languages based on mathematical principles, such as the functional programming languages."

This is no mean task, since it is largely unknown territory. A tentative approach to declarative languages can be made by programming in Lisp or Prolog, neither of which are mathematically pure; it is also possible to build parallel processors operating with barely altered conventional languages. Alternatively a complex specialized set of software instruments can be built up to transform Lisp or Prolog programs, and make them run more efficiently on a specific type of machine.

Unanswered Questions

These are all ongoing events, and a lot of money is being made, but Flagship wants to go one step further. Darlington has pointed out that many questions remain unanswered: "Is it possible for functional and other languages to support a wide range of practical applications without losing their simple, pure base? Could the extremely formal mathematical technique of program transformation be used for major programs? And is it possible to build real parallel machines in which full potential is reached in economical terms?"

In Darlington's opinion all these questions can be answered affirmatively in theory. It is Flagship's task to supply practical evidence. "In the conventional (Von Neumann) method all these advantages are not even present in theory, even though great achievements have

been made with new software and innovative hardware." The implication being that the frontiers of this method are gradually being formulated.

The mainframe systems department at ICL in West Gorton, Manchester, is also convinced that the Von Neumann approach is outdated from an economic point of view. Colin Skelton, the general manager of the Flagship project, and Brian Procter, the technical manager, point out that although the price/performance ratio of semiconductors has improved every 5 years by 10, this figure is only 3 for assembled hardware.

The actual value of information systems (hardware plus software) for the end user is difficult to assess but they believe it increases even more slowly. "The improvement of the price/performance ratio at machine level has not followed the favorable trend in the price/performance ratio of components," says Procter. If, in addition to this "hardware gap," there is also a "software gap," the difference between the potential and actual value of information systems becomes even greater.

Technology Deceleration

It is quite obvious that the progress made in semiconductor technology will slowly come to a standstill in the 1990's, so that systems manufacturers will be obliged to find other ways of enhancing the value of their products. They will have to consider new architectures to bridge the hardware gap and new software techniques to fill the software gap. In view of this impending crisis ICL, and consequently the UK and Europe, hope to have a lead on competitors with the technology developed by Flagship.

In the same way as the farmer and his boat, the Flagship team is not expecting to cross the river in one go. The project includes a number of phases for the development of hardware, languages, and software. The functional language Hope was a starting point, and long before the actual project had even been conceived, Hope had been used by the Imperial College to determine how the ALICE machine could support declarative languages.

Transformation

ALICE's hardware was built by ICL in accordance with industrial specifications that probably could not have been enforced in a university. In July 1986 the Imperial College acquired a prototype with 16 processors and 26 storage units. "This suddenly made our work on the software very concrete," says Darlington. ALICE is a parallel machine with a number of hardware characteristics that can be used advantageously if programs are cast in the right mold. This is why the machine proved useful for testing program transformation techniques.

One of the techniques used is "memoization," in which the program structure is altered in such a way that values used more than once are stored and retrieved instead of being repeatedly calculated. Memoization is especially suitable for correcting the algorithm to calculate the Fibonacci sequence. This is in fact the recursive definition fib(n)= fib(n-1)+fib(n-2). The important point is that the two calculations on the right need not be repeated whenever the definition is retrieved. It is only necessary to store the last two calculated figures and add them.

Secondary calculations are always eliminated during the compilation but the standard method cannot be applied here because with this method the secondary calculations must have exactly the same form as in the source program. This is not a requirement for memoization, as cases are sought in which the same value would have to be calculated twice even though the code is different.

The manner in which memoization is implemented at the Imperial College (the initial idea is not new) can be described as "automatic yet conservative." According to Darlington "memoization is always possible when it is indicated." However, inevitably some opportunities are missed. It can even be proved that it is impossible to track all cases. The basic idea though is that the programmer remains in full control. In Darlington's words: "In the type of transformation system we are attempting to set up with ALICE, the user makes upper-level decisions concerning the design, whereas the machine carries out and controls these decisions."

At ICL program transformation is now considered the basis for a new style of software design for the 1990's. In the best case a program must clearly reflect what it is expected to do. The program must also make optimum use of the machine's features. It is hoped that program transformation will be the key to solving the conflict between these two requirements.

Formal Specification

In the main program design phase, the code must remain as clear and understandable as possible. Once a prototype program has been subjected to a few trial runs, the designers will decide on a formal specification. In this case, contrary to most specifications, the program must be performable.

Furthermore, the program must be tuned so that it can run efficiently on a specific machine or machines, either in parallel or in sequencial mode. A high degree of competence is needed because this process requires knowledge of the machine as well as of the application. However, few things can go wrong since the meaning of the program does not change, no matter how many transformations are performed, and therefore accidental errors are not likely to occur. However

intricate some transformation strategies may be, they are always based on fairly elementary operations built into the system and of proven mathematical reliability.

Documentation

These elementary operations constitute a so-called metalanguage. While tuning the program, the programmer develops and refines a program in a metalanguage. This is the so-called transformation plan. This plan comprises an accurate report of the transformations used to improve the target program. At the Imperial College, Hope (and its successors) are used as metalanguages.

In this software development model two "documents" play a major role, namely the specification and the transformation plan. With these two documents the target program can be developed automatically. In the words of Brian Procter of ICL: "This not only allows us to separate the specification from the program improvement, but also enables us to define for future generations what improvements have been implemented."

This system is considered to be the key to rapid, reliable, and economical software maintenence. Maintenance plays a major role in the present crisis of the software industry. "Today in many places approximately 90 percent of the budget is spent on comparatively minor improvements to existing programs," says Procter, quoting the statement that "design is no more than a special kind of maintenance."

It is intriguing that maintenance can be fully restricted to the specification, so that the usually less understandable improved code is not affected. Obviously, the revised specification must still be transformed into a usable program, but according to Procter "it is likely that in most cases the original transformation plan can be applied to the new version of the specification, and thus allow a program to be developed without any further assistance." The tuning of programs then becomes a once-only operation.

The appearance of Flagship's future hardware is not so much reflected in ALICE as in a software model running on Sun workstations or on ICL mainframes under the VME operating system.

The next step will be the setting up of a more detailed emulator or "total model" including some characteristics in microcode, so that some space is left in the hardware for final-step design adjustments.

The emulator will use microprocessors of the 68000 series. The Motorola chip was preferred to the British Inmos Transputer, specially designed for parallel processing and used in ALICE, because it allows more applications. Experiments with the emulator will eventually lead to the final design of a processing unit manufactured as a VLSI (Very Large Scale Integrated) circuit. This stage will only be reached once the financial support of Alvey is discontinued.

High-Quality Software

The aim is to be able to build systems ranging from a few to a couple of hundred processors within the same general architecture. Together with the declarative languages and the tools for program transformation it must be possible to create a powerful package for the development and supply of high-quality applications in the 1990's. The parallel hardware—probably the most striking aspect of Flagship—is to a certain extent the least essential. "Parallel machines are indeed important to us, but only in combination with a number of other matters," says Procter. For ICL the most promising prospect is that they will be able to develop, supply, and maintain software more quickly, more cheaply, and with fewer errors, whereas the powerful features that the users will be focusing on in the coming years are also being introduced. This software must not only be oriented towards the parallel Flagship machine. Indeed, that would probably be tantamount to economic suicide.

ICL will probably pass on some of its "fifth-generation" research results to established users of the Series 39 mainframes. Especially now that the company has accepted the principle of dispersed outlets and the need for an international or European standard, it will be in a position to extend its market share considerably.

25059

FRG's 'Suprenum' Supercomputer to be Marketed in 1989

36980005 Duesseldorf HANDELSBLATT in German 1 Oct 87 p 18

[Excerpts] "We now have a market for increasingly faster supercomputers," Prof Ulrich Trottenberg, director of Suprenum GmbH, Bonn, says in assessing the prospects for selling the "Suprenum 1," the first parallel supercomputer, starting in 1989. The initial scientific applications on the so-called "Preprototype 01" have been underway since spring of this year. "Through these applications, parallel computing is demonstrated as being functional and is made visible by means of graphic tools," Dr Klaus Peinze adds, who also is a managing director of the company, founded in 1986. With support from the Federal Ministry of Research, the company's objective is to develop a computer for highly complex tasks.

This large-scale joint project was initiated in 1984 by Prof Trottenberg, whose objective was to reach a breakthrough in the area of scientific computer applications by utilizing super-fast numerical methods. A parallel system with powerful and local memory units was decided upon. The first "pre-preliminary model" has now been in operation since spring. The company took

advantage of the second international Suprenum Colloquium, being held this week in Bonn, as an opportunity to assess progress to date and to provide an outlook for the future.

According to Trottenberg, the demand stemming from scientific curiosity for increasingly more powerful supercomputers is not the only reason behind the need for separate development in this area: supercomputers would also make it possible to derive more complex and more precise mathematical models. A great demand for large computers is also coming from aerodynamics, meteorology, energy research, elementary particle physics, semi-conductor physics, chemistry and geology.

Therefore, Trottenberg foresees a favorable response to the Suprenum parallel supercomputer, which initially will be capable of four and, later, 10 billion computations per second (10 gigaflops). In three to six years, a Suprenum II may even follow as a European Eureka project.

The main phase of the project has been in progress since May 1985. The Federal Ministry of Research and the state of North Rhine-Westphalia are financing the project, which has 150 employees from 4 large research organizations, 5 universities and 5 companies in industry. The total costs for the project from its definition phase (starting in April 1984) to the end of 1989 are estimated at approximately DM 180 million. More than half of this amount will go toward software development.

The main responsibilities for managing and coordinating the individual activities of the 14 partners, who are responsible for their separate projects, were transferred to the Suprenum GmbH—capital stock of DM 3 million—founded in 1986 for this purpose. The corporations involved are Krup Atlas Elektronik GmbH, Bremen (54 percent, 27 percent of which is in trust), the Association for Mathematics and Data Processing mbH, St. Augustin (20 percent), the Stollmann GmbH, Hamburg (18 percent), a BGB company (3 percent), and the two directors Trottenberg (3 percent) and Peinze (2 percent). Suprenum GmbH itself currently has approximately 30 employees, primarily mathematicians, engineers, information scientists and physicists.

Dr Heinz Peinze considers the introduction of the "Preprototype 01" to be a stabilizing element in the development of the supercomputer, "Made In Germany" in view of the fact that problems during the initial and developmental phases had portended a delay of approximately a year with respect to the original plan. Also, the computer is constructed exclusively from purchased components. According to Peinze, the advantage in this policy is that state-of-the-art components can be utilized without incurring the costs associated with developing new special chips.

In hindsight, Trottenberg deems it to Suprenum's advantage that Siemens is not directly involved in the project. "With Siemens," he says, "the development of chips would have involved substantial effort; our project would have become quite different."

12399/12913

DEFENSE INDUSTRIES

Firms in UK, Scotland Study Helmet-Integrated Vision Systems

36980055 Munich FLUG REVUE in German Nov 87 pp 95, 98-99

[Excerpts from article by Helga L. Hillebrand: "All in the Visor"]

[Text] The helmet, originally developed for the protection of the crew, today fulfills a large number of additional tasks. The pilot is given the most important flight and target data on displays integrated into the visor. It is even possible to guide weapons by means of sight line measurement.

The most modern function of the helmet is reminiscent of medieval horror stories about the "evil eye:" a human being who is able to destroy a target just by staring at it. But what was then superstition and slander is reality today. Highly developed electronics and weapons technology make it possible.

The Israeli electro-optical industry appears to have a certain lead in this field. DASH (Display and Sight Helmet System) is a development of Elbit Computers, Ltd., Haifa. It was tested on a two-seater F-15, but can be integrated into any pursuit or fighter aircraft.

Head Position Determines the Direction of Fire

Ferranti, Edinburgh (Scotland) is offering its system for sale—although not for deployment in flight equipment. To be sure, the helmet vision system which also has this target function, was developed for helicopter and VTOL aircraft, but the first order came, surprisingly, from the Royal Army.

The way these helmets with target acquisition function is largely identical. If the pilot or weapons system officer (combat observer) detects a target, such as an enemy missile or an enemy aircraft, today he activates his guided missiles just by pushing a button, and tomorrow perhaps by speaking a word. The onboard integrated target tracking system then takes over the guidance data from the line of sight, tracks the target and guides the weapon in the appropriate direction. For the pilot this has the advantage that he does not primarily need to aim his aircraft toward the target, which would require additional maneuvers and lengthen reaction time.

The line of sight is given by contact-free measurement. There are several methods for this, which nearly all do not take into account the eye position of the pilot, but only the angle at which he turns and bends his head. At Ferranti a weak electromagnetic field is created with low power. A sensor on the helmet which is inside this field measures the fluctuations in the field, from which the movement can be determined. It is possible to measure head turns up to 360 degrees, up and down movements of 90 degrees each and helmet inclinations up to 18 degrees. Helmet positions which are a combination of these axes are also recorded. Another possibility of sight line determination consists of three optical measurement units, one above and one to either side of the pilot in the cockpit, which are aimed at marker points on the helmet.

A completely different route is taken by MBM Technology Ltd., Brighton, East Sussex, England. They call their helmet vision system Rear View Display, which is not intended to mean that the pilot sees what happens behind his back. On the contrary; the engineers pursued the concept that a screen does not necessarily have to be installed in the direction it displays. And so instead of in front, they placed the actual cathode ray tube with its display in the instrument panel directly behind the pilot's head. The advantage: The field of view of a head up display is primarily limited by the fact that the observer sits relatively far from the display (after all, he has to put his legs somewhere). The distance between the back of the pilot's head and the wall behind him is considerably less. The helmet therefore received a small camera optical system, which records the information from the rear display. From there it is transmitted by means of glass fibers which run inside the helmet from the neck to the forehead across the top of the head. A second optical system, aimed vertically down and ending with the helmet at the level of the forehead, reflects the data on a small, inward-angled, semitransparent mirror which is the actual display.

A Few Additional Grams Can Weigh Heavily

Of course, there are more electro-optical companies working on helmet- integrated vision equipment. Smith Industry in England, for example, only recently began development work, so that nothing has been learned yet about their results. Also in England, Marconi Avionics is working on such helmet displays.

The next step is presently being tackled by Ferranti: Even more functions, such as night-vision goggles, will be included in the integrated helmet of the future. The helmet displays of today can of course, just as a HUD [head up display], show FLIR [forward-looking infrared] images, for which the sight line measurement serves to aim the night-vision camera.

A helmet without these additional functions weighs around one kilogram. About 200 to 300 grams are added for the helmet displays and their electronics. That does not sound like much, but when these weights multiply with the corresponding g-forces it is important that the helmet is well balanced.

PHOTO CAPTIONS [photos not reproduced] The pilot is able to aim just with his eyes, as shown by the illustration for the DASH helmet by Elbit. With the Bendix/Elop helmet the pilot sees the data overlaid on the image (large photo).

The Rear View Display by MBM uses a CRT [cathode ray tube] behind the pilot's seat and acquisition optics in the neck. Ferranti as well provides CRT on the helmet and eye-controlled weapons guidance.

11949

FACTORY AUTOMATION, ROBOTICS

French Integrated Manufacturing Trade Fair Reviewed

36980A005 Paris CPE BULLETIN in French Jul 87pp 53-55

[Article by Guy Benchimal: "Problem Solving and Futurology of Manufacturing Integration; Report on the First International Integrated Manufacturing Show - INTEGRA 87; Paris (Palais des Congres), 4-5 June 1987"]

[Text] The First International Integrated Manufacturing Show, INTEGRA 87, which was held in Paris at the Palais des Congres, was organized by Hermes Scientific and Technological Publishers, and led by Guy Benchimol. It served to define the current problems in integrating an organization's activities; it brought together those responsible for manufacturing, methods, or CAD/CAM from various specialist areas: mechanics, electronics, agro-food, packing.

It looks as though we cannot escape the creation of islands of automation, but we have finally understood that they must be considered, from the very outset, as modules which will eventually be integrated into a greater whole. As long as we remain in the same field, it appears as though the obstacles to integration will be surmountable, especially if we have relative homogeneity both in the materials which will function together and in their applications. These modules already exist, as do the networks which interconnect them and the available technology which creates them. Users begin to get into trouble when they try to make different applications in different fields communicate with each other and with manufacturing management, manufacturing management with organizational management, marketing with CAD/CAM, etc. The activities are different, they do not overlap, do not have the same values. The same is true for their relationships. The result is that it is very difficult, given the present state of the technology, to make such applications communicate among themselves. That is the reason, as various different ISO [International Standardization Organization] committees have recommended, that it is necessary to organize information in a uniform manner in all applications.

Although standards have not yet been established in this area, we can still recommend that users take note of the projects developed within the ISO to structure their information. This will facilitate their integration task and they will find it easier to conform to the standards once they come into effect.

Nevertheless, the problem of communication between differing fields is not the only one. If communications can help overcome the difficulties inherent in the integration of a few islands or modules, it is not enough to resolve the strategic design problems of the large integrated units which require complex models such as a company model. We can creat a functional or a conceptual model. It is a lot more difficult to go from this model to the logical model when there are no direct points in common between the different functions and a set of software packages or of modular software on which we have to connect the information system which allows the different fields to communicate. We thus have three different holographic layers of a common reality:

- the functional and decisionmaking organization, - the logical architecture, - the information system.

We lack, except in very simple cases, a metamodel that can ensure the coherence of these three layers. This particular lack is the major difficulty which integrated systems designers encounter today. It is true that a problem can frequently be overcome by avoiding it in some specific nontransferable ways which results in a spectacular finished product that makes integration look easy. This holds true for the detailed presentations desplayed at INTEGRA 87: Ingersoll Milling factories United States, which produce machine tools whose prices range between $1.5 and $3 million, the European Aerospatiale network, the European IBM and Hewlett-Packard factories, or the Thomson group factories introduced by Guillaume Benci of Thom's.

But Guy Marechal of Brussels' N.V. Philips and MBLE Associated SA opened the participants' eyes when he introduced the Arcade [Architecture for CAD in Electronics] project for communicating between heterogeneous systems and different fields, and by demonstrating the conditions that had to be imposed on the various Philips work groups to allow the system to work in an experimental way, while awaiting the publishing of international standards.

The most common methods for circumventing integration problems are as follows:

—Work in a unique field: As the information is not structured ideally, it is considerably diluted, and so the application field is restricted to a relatively simple whole which will certainly not cover the size of the company.

—Closely match the data processing architecture made up of modular software packages to the functional model. This solution is valid for conventionally structured organizations. Elsewhere, the solution is to adapt the software packages, or in an extreme case to create custom software, which can require considerable effort.

—Establish manual interfaces which, whenever a problem of translation from one context to another appears, allow a human operator to step in and make the translation from a terminal.

What can be hoped for in the future?

—Systems allowing the creation of models based on primitives linked to standard functions or relations, which consider the present procedural complexities which are not only sequential but also parallel, closed, and iterative, and thus synchronized;

—Interactive software management workshops allowing man to express his desires in terms of ends and not of means;

—Metamodels which, from a given integration and decision level strategy, act as a framework for conceptual, logical, and data processing models, ending up with a global and complete architecture.

In any case, to avoid a proliferation of approaches, it is desirable for international standards to supply a general framework for these future systems. Until then users must try to have a futuristic vision. Instead of working case by case and avoiding the current major difficulties, they must prepare for more significant ones in the future, when integration will have generalized tools. The protection of their investment is in the balance.

Gabriel Dureau, president of the ISO's "Industrial Automation Systems" committee (and of other bodies as well), demonstrated at INTEGRA 87 that the seventh layer of OSI communications would not solve the problems of data exchange and that to make a system completely transparent when seen from the man-machine interface, you must add the layers needed to understand the data and its processing (application program languages). Jose Audy, of Aerospatiale's Central Manufacturing Management, illustrated this point effectively when he showed the number of different views one could have of the same product depending on whether one was in marketing, preliminary or detailed design, manufacturing, quality control, or product support.

In conclusion, we believe we speak for the majority of the participants in hoping that the next INTEGRA show will allow for additional:

—demonstrations of accomplishments based on increased observance of these new principles,

—opportunities for corporate strategic management to become interested in this common study so that they become involved and introduce overall strategic issues.

25051

LASERS, SENSORS, OPTICS

ESPRIT 688 Project's Theme Is CIM-OSA

3698A006 Paris CPE BULLETIN in French Jul 87p 56

[Text] CIM-OSA is the ESPRIT 688 project's theme. Its purpose is to define a computerized and integrated open manufacturing system. This project links 19 European companies (manufacturers, computer manufacturers, service companies) and should soon publish the first public document (OSA-0) describing the basic principles. The next document (OSA-1) on the system's functional architecture is expected in 1989. Software suited to the resulting architecture will result in the creation of a completely transparent interface between a user having an ordinary terminal and machines, applications, and databases which are more or less heterogeneous, and which, in a way, are the outer layer of the main computer's operating system. The principle has been tested under limited conditions in Philips' ARCADE project which is operational in two of its centers. (Footnote)(ARCADE: Architecture for CAD in Electronics; North Holland—COMPUTERS IN INDUSTRY 5, 1984 pp 3-20.) The premise arises from the fact that a particular concept can be perceived differently depending on one's point of view and on the way in which one's data processing environment is linked to the context. Also, instead of trying to represent the data in its various contexts uniformly (design, manufacturing, supply, distribution, after sales, etc.), they allow these views to coexist within the particular concept which acts as the master view. Each view can then be the subject of different versions, at a given moment or through the various successive stages of its evolution.

So instead of the coexistence of different representations of the same concept, each one incompatible to the others, there is rather a different view of the same object, defined in a unique way, and organized around a master concept in a repetitive manner, each one of these views able to be studied as an object.

The sum of the views relating to a single object is organized in a way which guarantees their coherence (electric, mechanical context, etc.).

This architecture can be generalized to any object including, for example, any physical object, a procedure, or a database. An object can consist of as many points of view as might be necessary. An electrical apparatus can include as one of its views a wiring diagram, for example; this wiring diagram can itself be described by a paper reproduction of its layout.

25051

New 5 kW CO_2Laser Used by FGR Firm in FLexible Production Line

36980050 Coburg OPTOELECTRONIK in German Vol. 3 No 5, 1987 pp 456-457

[Text] The firm of J. M. Voith GmbH in Heidenheim seems excellently equipped for the requirements of the future factory.

The first 5 kW production laser recently began operation in the Garchingen plant. In the framework of a flexible production line, two-mass flywheels are welded in series. The two weld seams, in which three different material compositions are combined, are of the highest quality and scarcely visible.

Further, an additional application station permits experimental welding alongside the normal production process.

The Voith plant was built and delivered by Leybold in Hanau. The laser unit is a high-frequency (27.12 MHz) pulsed longitudinal-flow CO_2 laser with a guaranteed output of 0.5-5 kW.

The construction principle of the LH machine tools around the laser is the modular construction. Up to 4 welding stations can be arranged around a central machine stand and be served alternately by a single laser via corresponding beam switches. The installation delivered to Voith is equipped with two work stations: a production station for series manufacture and an application station for trying out new uses.

Welding time is maximized by means of the two-station operation: While the laser is engaged in series production at the main station, at the same time the laboratory station can be assembled or disassembled in parallel. When the station is ready to weld, the laser beam needs only to be redirected by means of the pneumatically activated beam switch; after the test welding it can continue its production without delay.

Downtime is thus limited to the loss of time (about 1 second) each time the laser beam is switched between the two stations.

The new production laser therefore achieves short cycle times and low unit production costs.

With a beam capacity of 5 kW great welding depths (up to about 10 mm) and high welding speeds can also be achieved. Distortion of the part is minimal due to the low heat load. Refinishing is eliminated.

In addition to the high productivity and the excellent quality of welding, it is above all the great flexibility which argues in favor of the new installation concept. Both stations of the Voith facility are activated with computer numerical control.

The production station is controlled along three axes. The track control for the experimental station has five axes.

All the functions of the laboratory station can be executed from a board via a numerical control panel with monitor and machine control panel. An identical second unit is available for the production station.

Each work station is thus capable of being separately installed and programmed, which not only increases operational comfort but above all reduces loss of time to a minimum.

With this flexible, highly productive, material processing center the house of Voith is excellently equipped for the tasks of the future.

PHOTO CAPTIONS

[Photos not included]

Fig.1: The 5-kW laser beam welding unit with two work stations and 2 computer numerical control facilities.

Fig. 2: Design concept of the LBW 5000 with 2 production stations and 1 universal station.

11949

French Sensor Technology Research Center Established

3698A009 Paris RECHERCHE TECHNOLOGIE in French Jun-Jul 87pp 16-17

[Article: "Sensors Club"]

[Text] The increasing demand for sensors in every field (procedure automation, automobiles, security of goods and individuals, medical technology, etc.) will significantly affect the way they will be produced: They will have to be miniaturized, be more reliable and cheaper. As a result they are a favorite field for applying new technologies.

To reinforce its research the "Sensor Committee" of the Ministry of Research and Higher Education has prepared a program proposal whose approach has been approved by sensor manufacturers: It involves creating or reorganizing appropriate expertise around a technological research core which manufacturers will be able to use.

The primary subjects included are:

- microsensors and semiconductors using microelectronic technology; - guided optics and sensors (optical signal transport, shared means, integrated optics); - sensors and associated systems (signal processing, communication networks).

These new technologies provide many opportunities. However, they require a high level of competence, of investment, and of research into fields where the risk is still considerable for small- and medium-sized companies, which make up a major portion of the sensor industry.

The idea of creating an expertise center in a research laboratory having considerable resources and open to precompetitive research programs run by manufacturers would be an interesting way to reduce R&D costs.

A move in this direction was recently made by the Atomic Energy Commission's LETI (Electronics and Data Processing Technology Laboratory) at Grenoble, which suggests the creation of a manufacturer's club, the Sensors Club, to initiate precompetitive research programs into microelectronic and integrated optics technology.

25051

MICROELECTRONICS

Overview of West European ISDN Strategies

36980030 Milan ELETTRONICA OGGI in Italian May 87 pp 51-56

Integrated Circuits

[Text] It is clear that, in order for ISDN to become a reality, there will have to be a substantial expansion of basic technology that will provide telecommunication systems designers with integrated components which would efficiently solve the problems connected with the handling of voice-data mix. Companies producing semiconductors which have entered the ISDN market are numerous—there are already more than ten. In the following, we shall present the strategies of some of the most important semiconductor companies. Many of these already have integrated circuits meeting the CCITT-ISDN standards; other companies have reached advanced research or test stages. It is not our intention to present a complete review of all products applicable to ISDN, but rather to furnish significant examples typifying market development.

SGS

SGS has concentrated its study and research efforts in the development of an integrated circuit for the management of the U interface, that is, for the direct control of

the communication line. The main problem tackled by the SGS designers was the type of technology to be used for communication management.

Presently, two strategies are being used: echo erasure, and 'ping-pong' systems. In the first approach very sophisticated components are needed (chips with over 100,000 transistors), but there are less limitations on the maximum communication distance and on transmission frequencies. In the second approach signals are repetitively sent over the line, from one end to the other, and this limits the method's applicability to short range communication systems.

SGS has developed a technique which integrates the advantages of the two different approaches, with costs similar to the 'ping-pong' systems. The technique is based on the encoding of signals into fixed length frames which are subsequently subdivided into three portions (information, echo, and a combination of the two). Since the system knows the content of each portion of the frame it is able to extract the data proper and information on the echo, and then uses this information to cancel the effects caused by the echo.

Presently, the device has been built on a logic card using gate-arrays: the first devices on single CMOS chips are expected for the second half of 1987.

The second SGS chip, called SMT 1C10, will include, among other features, a line interface, an encoder-decoder, an equalizer circuit, a module for echo cancellation, and a 12-bit analog-to-digital converter. The transmission speed is 144 kb/s and it is possible to achieve transmission distances of several kilometers. The integrated circuit conforms to the ISDN standard of CCITT.

Siemens

Siemens offers a large selection of integrated circuits for ISDN applications, all based on CMOS technology.

PEB 2070—The principal function of this integrated circuit is to handle channel D protocol. The chip includes a FIFO structure of 64 bytes for each direction of transmission.

PEB 2080—The circuit allows a four wire interface of the S type, CCITT standard. In addition to the functions required by the ISDN standards, the chip includes additional functions which can simplify specific applications. The device also furnishes typical transceiver functions, various recovery modes, and allows a maximum of eight terminals to be connected to the same network.

PEB 2085—This device integrates in a single chip the functions available in the two previously mentioned components.

PEB 2090—The PEB 2090 allows full-duplex transmission of voice signals or data on telephone lines (type U interface). Relevant characteristics of the chip are: a maximum 8 Km transmission distance, transmission speed of 144 kb/s, use of echo cancellation technology, functions for recovery management, and possibility of control by means of software.

PEB 2095—This device, analogous to what takes place in the PEB 2085, integrates in a single chip the functions of PEB 2095 and PEB 2070, and it also is meant mainly for the management of PABX systems connections.

PEB 2050—The 2050 accomplishes the control of voice signals, data, and housekeeping signals for a maximum of eight lines. It uses the interface between the standard SLD bus, the PCM communication system, and the on-board microprocessor.

SAB 82520—The purpose of this integrated circuit is to interface high speed communication lines which utilize X.25 protocol of level 2 or the access procedures for type D channel with a microcomputer.

Thomson

Thomson Semiconducteurs has prepared a research and development plan for ISDN integrated circuits based on integrated components using HCMOS and CMOS technology. The components presently being studied are aimed at offering efficient implementation at all levels within the ISDN standard. The circuits being developed are:

Name	Function	First availability
SID-1	S-interface	Fourth quarter of 1987
SID-2	S-interface	First quarter of 1988
UIT	U-interface Transceiver	Second quarter of 1989
HC	HDLC-controller	Third quarter of 1988
IPS	ISDN-power pack	First quarter of 1988
ITC	ISDN-integrated circuits for telephone	Second quarter of 1988

Also predicted for a later time is the development of other integrated circuits for the control of communication protocols, and for terminal adapters.

SID-1—This integrated circuit provides basic control functions for the S-interface. Summarizing briefly its principal characteristics, it is to be pointed out that the receiver allows the maximum distance of the standard I430 to be extended to 1.5 km. Applications for which the circuit is particularly suited are PABX line-cards, NT1 and NT2 type devices, and terminals.

UIT—This component is a transceiver for the U-interface and allows the management of a full-duplex transmission on a 2-wire line. The maximum transmission distance is 8 km.

ITC—The principal characteristics of this device are the integration of various circuits on a single chip: typical examples are a circuit for encoding-decoding and filtering, a programmable controller for gain during reception and transmission, a control circuit for an auxiliary speaker outlet. The chip, which can be controlled by a microprocessor for the selection of B1 and B2 channels, is specifically designed for audio components of network terminals.

13120/12913

SCIENCE & TECHNOLOGY POLICY

Fraunhofer Chief on Fiscal 1986 Activities, FRG R&D Policies

36980007 Dusseldorf HANDELSBLATT in German 1 Oct 87 p 3

[Text] osl Munich. At a press conference in Munich, Prof Max Syrbe, President of the Fraunhofer society, cautioned against furthering space exploration at the expense of a broader support for economic expansion.

Up to now the Federal Republic of Germany has focused its research effort on basic research and on promoting its technological competitiveness. A stronger commitment to space just should not be permitted to shift the priorities to national prestige objectives, Syrbe said, because "this would no longer be in keeping with the vital interests of the industrialized Federal Republic."

It appears there is a heavy emphasis on promoting space exploration on account of the "necessary integration of European high tech and independence from the United States." Syrbe, however, views the priorities differently: most important for Europe is the complete opening of markets, cooperative projects such as the Eureka program and the development of a competitive position in world trade. To reach these objectives, research is needed mainly in the areas of information systems, biotechnology and new materials.

"Space is not everything," Syrbe said, and he pointed out that projects of such magnitude tie up for long periods of time, not only large sums of money but also, based on experience, cause unforeseen and thus unavoidable cost increases.

"We support the efforts of the FRG Research Minister to limit the space research related expenses, including the institutional requirements in his budget, to 19 and no more than 22 percent," which amounts presently to about DM1.5 billion a year.

The Fraunhofer Society was able to spend during fiscal year 1986 a total of DM512 million, i.e. 17 percent more than in 1985, and twice as much as in 1981. Eighty-six percent was earmarked for contractual research, while defense research decreased to only 11 percent, and service industries received 3 percent. Syrbe said that "the driving force of our growth comes from the business research contracts, which increased last year by 33 percent to DM101 million for 1,800 individual projects. The research orders placed by the Federal Government and the States rose by 14 percent over the previous year to a total of DM106 million.

The number of workers increased by 8 percent to 4440. Syrbe sees in the 9 percent fluctuation rate, especially in the change with respect to industry and the universities, a desirable "transfer of technology over heads." In addition, since 1980, 44 new enterprises that now employ 400 workers were created by former Fraunhofer scientists.

For the next few years Syrbe anticipates further growth, mainly due to an increased industrial interest in cooperation. About half of the orders originate from small to middle-size enterprises. "The development of complex technical systems, nowadays accounting for about 25 percent of our work, continues to gain in importance in relation to the development and improvement of individual materials, products and processes", President of the Fraunhofer Society remarked. The main emphasis of the Fraunhofer Work is in the areas of microelectronics, information and production technology, environmental research as well as solar technology.

/12913

ADVANCED MATERIALS

Superconductivity R&D in GDR

23020001 Berlin WISSENSCHAFT UND FORTSCHRITT in German No 9, 1987 pp 233-236

[Article by Dr Stefan-Ludwig Drechsler, Central Institute for Solid State Physics and Materials Research of the Academy of Sciences of the GDR, Dresden, at present at the VIK [Experimental Low Temperature Institute] Dubna, Laboratory for Theoretical Physics; Dr Eberhard Mrosan, Dresden Technical University, Physics Section, at present at the VIK Dubna, Laboratory for Theoretical Physics; and Prof Dr Paul Ziesche, Dresden Technical University, Physics Section: " 'High-Temperature' Superconductors"]

[Excerpts] One of the most interesting processes of solid state physics is superconductivity. The following article (based on a colloquium lecture at a seminar for theoretical physics in Dresden) supplies early information on this fascinating development.

Since the beginning of the year a sort of "gold rush" has spread "like wildfire" among physicists all over the world. People are talking euphorically of the invention of the century. Within a very short period of time these new superconductors were produced and investigated at many research establishments all over the world, and therefore at the VIK Dubna as well. Even installations which previously had nothing to do with low temperature physics have gotten into the new development. In the GDR as well scientists are working on this problem. Accordingly, in April of this year it was possible to produce, at the Central Institute for Solid State Physics and Materials Research of the Academy of Sciences of the GDR in Dresden, a material whose electrical resistance drops strongly at a temperature of 91 degrees Kelvin and is no longer detectable at 83 degrees Kelvin. The samples' diamagnetism is characteristic of superconductivity. At Humboldt University in Berlin as well, samples with transition temperatures between 88 and 95 degrees Kelvin are being produced and intensively investigated. The same holds true for the Dresden Technical University and the ZfK [Central Institute for Low Temperature] Rossendorf.

In the meantime the assessment made after the first great "push" in the spring of this year that "now the bustle is over and careful detail work is beginning" may again require correction, because the latest reports (this time apparently to be taken more seriously) on indirect evidence for transition temperatures of 240, 270, and even 300 degrees Kelvin invite attention. If such reports are confirmed, news about the stability of these superconductors must be awaited. For engineering applications the statement is also very important that it has been possible through improved manufacturing conditions (for example, epitaxy) to obtain pure superconducting phases with transition temperatures close to 100 degrees Kelvin which have current intensities of $10^5...10^6$ amperes per square centimeter.

From this fascinating development it must also be concluded that this article—for which reports or comments were supplied by Dr H. Eschrig (ZFW [Central Office for Heat Economy] Dresden), Dr J. Schreiber (Dresden Technical University), Prof Dr R. Knoener (Dresden Technical University), Prof Dr E. Hegenbarth (Dresden Technical University), Prof Dr R. Herrmann (Humboldt University, Berlin), Prof Dr J. Richter (Physics Department of the Academy of Sciences of the GDR), and Prof Dr W. Buckel (Karlsruhe)—can only be preliminary, and will be followed by others soon.

5586/6091

BIOTECHNOLOGY

Use of Radionuclides by CSSR Nuclear Biology Institute

24020035 Prague TECHNICKY TYDENIK in Czech No 3, 13 Jan 87 p 1, 3

[Interview with Engineer Josef Benes, Doctor of Sciences, Director of the Institute of Nuclear Biology and Radiochemistry of the Czechoslovak Academy of Sciences in Prague, conducted by Blanka Brablecova]

[Excerpts] Applications-oriented research at the Institute of Nuclear Biology and Radiochemistry of the Czechoslovak Academy of Sciences (CSAV, Ceskoslovenska akademie ved), although it has very specific aims, on the other hand enriches in every way the work of practically all the biological institutes of the CSAV—as well as broad fields of agricultural, medical and veterinary practice. And indeed its interconnectedness—the Institute cooperates with three manufacturing enterprises and 36 research institutes—impressed us. What significance do radionuclides have, for instance, in human medicine, where modern radioimmunological analysis is sued? What do the results of scientific research signify for our national economy? More on all this inside this issue in a conversation with the Institute's director, Engineer Josef Benes, Doctor of Sciences.

[Answer] We conceive our goals from a long-term perspective to be such that newly discovered knowledge will be assured of application in an ever-broader sphere of scientific specialties and will contribute to the nationwide exploitation of experimental results as primary productive forces in the work of society. We are also a workplace with a broad multidisciplinary character. To acquaint TECHNICKY TYDENIK readers with some of our work: In research and development on methods of preparing new types of biologically active substances tagged with radionuclides we have succeeded in preparing so far 350 compounds tagged with isotopes of hydrogen, carbon, iodine, phosphorus, sulfur and selenium.

Many of these processes have become part of the Institute's production program for research, development and exploitation of radioisotopes of the Czechoslovak Commission on Atomic Energy. I am referring mainly to amino acids, peptides, fatty acids, saccharides, a number of pyrimidine and purine bases, antibiotics, steroids, mycotoxins, etc.

[Question] All of this also comes about thanks to widespread scientific cooperation...

[Answer] And also international cooperation. We cooperate with the Biological Center of the Hungarian Academy of Sciences and with the Institute of Bioorganic Chemistry of the USSR Academy of Sciences, and before the end of this year (1987) an agreement will be concluded with the Institute of Plant Physiology imeni Timiryazev of the USSR Academy of Sciences. Furthermore, we are participating in two programs of the World Health Organization: the Chemical Safety Program and the Reproduction Program.

For 10 years now we have been solving problems in a program of development and routine provision of radioimmunoanalysis services in Czechoslovakia. The program of synthesis of radioligands and protein conjugates is concentrated in three areas: steroid hormones, mycotoxins and ergotic alkaloids, and selected peptide proteohormones. The results of research in steroid hormones find application chiefly in endocrinology, for example in the reproduction of domestic animals. I am referring to timely diagnosis of fertility, investigation of the hormonal profile, etc., which will be useful also in human diagnosis. The second area is that of screening tests and precision determination of the presence of aflatoxins, for example ochratoxin, based on radioimmunoanalysis (RIA). One result will be timely detection of hazardous substances in consumer products and foodstuffs. In addition to directly protecting human health, this will help prevent major losses in agriculture. The third area of our endeavors includes RIA of the angiotensin and encephalin system, as defined in human medicine. We already have to our credit 30 such RIA of systems. These are carried out in research institutes and health care facilities. Together with the Institute of Radioecology and Exploitation of Nuclear Technology of the Czechoslovak Commission on Atomic Energy in Kosice we share 5 certificates of innovation and 3 inventions for which patent notices have been issued. The results of research have also been used in the production of 5 commercial RIA devices.

[Question] The research in human medicine is genuinely interesting. Could you say something more about it, Comrade Director?

[Answer] In the field of radiosaturation methods, a new concept has been formulated and experimentally established of the role of lecithin cholesterol acyl transferase (LCAT) in the origin of cardiovascular diseases. It has been confirmed that the biochemical indications preceding organ damage are connected with the function of LCAT, which distinctly influences the endogenous kinetics of cholesterol. In the same way, an effect on the metabolism of cholesterol has been shown in diseases which carry a high risk of development of ischemic disease, for example in hypertension or in kidney failure. In them the effect on lipid metabolism is not manifested in high plasma cholesterol levels.

In connection with these discoveries we are already able to offer a commercially available diagnostic kit for detecting disturbances in cholesterol metabolism, the introduction of which into clinical practice should lead to improved diagnosis and testing of the effectiveness of therapy in cases where there is a choice of therapeutic treatments. Further research is directed towards establishing LCAT concentrations by radioimmunoanalytic methods, and, in cooperation with clinical institutions, towards seeking methods of pharmacological regulation both of the concentration and the activity of the enzyme. The goal is to have an effect on endogenous cholesterol exchange.

[Question] Problems in radiochemistry belong, of course, to theoretical basic research. On one problem you have been cooperating with Soviet specialists from Dubna. What does it deal with, specifically?

[Answer] It has to do with studying the physical problems of the orientation of atomic nuclei at temperatures in the thousandths of a degree Kelvin by methods of nuclear spectroscopy in which radionuclides are used which have corresponding nuclear properties. These are radionuclides in carrier-free form, with high average radioactivity levels, which are not commercially available: radionuclides of lanthanum-series elements, transuranium elements and other elements. The radiochemical tasks involved in the isolation of them guarantee our Institute a voice in the drafting of the protocol of cooperation on implementation of the SPIN research program with the Laboratory of Nuclear Problems of the Unified Institute for Nuclear Research in Dubna. Personnel from the Low-Temperature Physics Section of the Mathematics-Physics Department of the Charles University in Prague and from the Physics Section of the Nuclear and Materials Engineering Department of the Czechoslovak Military Institute of Technology (CVUT) in Prague are also taking part in this research program.

[Question] The influence of the biological activity of selected chemical compounds and elements on the living organism also touches on the area of the environment, the protection of which is among the priorities to be pursued in the Eighth 5-Year-Plan. What is the basis for the research in this area? Which direction are you primarily aiming at?

[Answer] One of the factors in the environment to which significant attention is being devoted by scientific and medical institutions is the so-called trace elements,

among them in particular the trace element selenium. Our Institute is studying its biological activity and the factors which affect it. An inseparable part of this research is the development of highly sensitive analysis methods. These in turn allow us to detect very low concentrations of selenium in biological materials. Thus with the help of these methods it has become possible to determine the concentration of selenium in the blood of our population. The results demonstrate that our territory belongs to a region with low selenium content. In light of the fact that selenium is an element indispensible for maintaining healthy functioning of the organism in many types of living things, and that an inadequate supply of it is linked with increased occurrence of certain diseases in man, it is necessary to devote greater attention to research on selenium for the sake of the people's health.

In conclusion, I would like to say that the rational use of knowledge gained presents us with the means by which to achieve understanding of the processes of genetic transformation and to develop biotechnical methodology. Radioanalytic methods are now in existence and will develop further in human and veterinary medicine in the diagnosis, therapeutics and prevention of certain diseases important in society, and in the heightening of the effectiveness of organic processes of industrial production. The introduction of proven radioimmunoanalytic methods in hygienic monitoring of the food chain will help protect the health of humanity and of the environment. And the recent progress in elemental analysis will make possible rational use of sources of fuel and energy.

It is worth noting that the Institute has achieved several original scientific discoveries. I am referring, for example, to their pioneering achievements with various catalysts, conjugates and ligands for radioimmunoanalysis, radiotests for enzyme reactions, etc. For these scientific accomplishments here at the Institute they have earned many awards, among them two Czechoslovak Academy of Sciences Prizes, awards from the Ministry of Health and from the government of the Czech Socialist Republic, and other awards.

Photograph Captions [Photos not reproduced]

The Director of the Institute of Nuclear Biology and Radiochemistry, Engineer Josef Benes, Doctor of Sciences.

Highly sensitive liquid chromatography is used to separate complex mixtures of solid and liquid substances. With its help it is possible to make quick and precise qualitative and quantitative analyses of reaction mixtures, monitoring the purity of the reactants and products. Doctor of Natural Sciences Petr Dufek keeps track of a measurement.

The method of atomic absorption spectrophotometry (AAS) serves to detect trace concentrations of elements. In the photograph, Doctor of Natural Sciences Jiri Dedina, Candidate of Sciences.

13289/12913

COMPUTERS

Trends in Computer Use, Education in Czechoslovakia

Computer Education at Technical Colleges

24020005 Prague MECHANIZACE A AUTOMATIZACE ADMINISTRATIVY in Czech No 8, 1987 pp 286-289

[Article by Professor Engr Jan Blatny, CSc (chairman of the Computer Department, Electrical Engineering Faculty, Brno Technical Institute) and Professor Engr Jaroslav Vlcek, DrSc (Automated Control Systems Department, Faculty of Architecture and Civil Engineering, Czech Institute of Technology, Prague): "Proposed Curricula for Electronic Computer Majors at the Technical Colleges in the CSSR"; first paragraph is the authors' introduction]

[Text] The purpose of this article is to inform the professional public about the changes proposed in the curricula for electronic computer majors at Czechoslovak technical colleges, where the problems of computer systems are covered in the greatest detail; furthermore, to request all professional workers to send their possible suggestions and comments to the following address: Professor Engr Jan Blatny, CSc, chairman of the Computer Department, Electrical Engineering Faculty, Brno Technical Institute, Bozetechova 2, 612 66 Brno.

Computer technology is undergoing rapid development and is gradually penetrating all spheres of activity. As more and more people come into contact with computer technology, the nature of this contact is broadening, and so is the nature of instruction in computer technology.

Typical of the present situation, however, is our considerable lag behind world development in terms of the availability of computers, and of the level of their utilization as well. One of the causes of this lag is the shortage of university and college graduates working in computer technology. A survey of 25 selected enterprises—they included, among others: the VUMS [Research Institute of Mathematical Machines] in Prague; the VUVT [Research Institute of Computer Technology] in Zilina; Kancelarske stroje [Office Machines]; Datasystem; Tesla Eltos [Tesla Electronic Components and Circuits]; the ZPA [Industrial Automation Plants] in Cakovice; and the ZVT [Computer Technology Plants] in Banska Bystrica—showed that only 20 to 60 percent of the jobs in computer technology requiring higher education are actually filled by graduates who majored

in electronic computers (at the electrical engineering faculties), computer science (at the universities) or automated management systems (at the VSE [College of Economics]). Between 20 and 40 percent of these jobs are filled by graduates of secondary schools. Many of the workers have been trained only for specific (hardware or software) systems. The rapid pace of progress makes obsolete within a few years the knowledge acquired in this manner; the workers who lack sufficiently thorough knowledge of computer technology's theoretical principles, and who are not accustomed to doing creative work independently, are unable to upgrade their qualifications on their own. As a result, the efficiency of their work, as well as of the products they produce, is low.

A detailed analysis of computer technology's development reveals that the prerequisites for a suitable level of training are not adequately ensured even in the present curricula for electronic computer majors at the electrical engineering faculties of Czechoslovakia's technical colleges, where the problems of computer systems are covered in the greatest detail. During the next 10 to 20 years, we will have to train:

1. Scientists, designers, and engineers for the branch of computer technology itself.

2. Specialists for computerizing the other branches of science and technology.

3. Computer users who will regard the computer as a problem-solving tool in their respective fields.

The training of the first two groups is the most demanding and the most important, because it is necessary to turn out creative workers who have an extensive and thorough knowledge of computer technology's theoretical principles, and who have mastered the rules, methods and techniques of identifying, evaluating and managing complex systems, and of solving engineering problems.

To consider these questions systematically, the CSR and SSR Ministries of Education set up a council on electronic computers as a major. The council's current members are as follows: Professor Engr Jan Blatny, CSc, Brno Technical Institute; Professor Engr Norbert Fristacky, CSc, Slovak Institute of Technology, Bratislava; Docent Engr Vlastimil Janes, CSc, Czech Institute of Technology, Prague; Professor Engr Milan Jelsina, CSc, Slovak Institute of Technology, Kosice; Docent Engr Josef Novacek, CSc, College of Mechanical and Electrical Engineering, Plzen; CSAV [Czechoslovak Academy of Sciences] and SAV [Slovak Academy of Sciences] corresponding member Ivan Plander, SAV Institute of Engineering Cybernetics, Bratislava; Docent Engr Imrich Rukovansky, CSc, Brno Technical Institute; Docent Engr Jan Staudek, Csc, Brno Technical Institute; and Professor Engr Jaroslav Vlcek, DrSc, Czech Institute of Technology, Prague.

After a thorough evaluation of the situation, the following proposals have been drafted with the help of many other members of departments that teach electronic computer majors:

- The professional profile of the graduate majoring in electronic computers, and its comparison—from the viewpoint of computer technology—with the professional profiles of graduates majoring respectively in engineering cybernetics, microelectronics and computer science;

- The curriculum for electronic computer majors;

- Brief syllabi of the special theoretical and applied courses.

These proposals are being submitted to the Ministries of Education, with the recommendation that instruction on their basis begin as of the 1988-1989 academic year. By publishing the proposals in this journal, we are soliciting the readers' views and possible suggestions, as mentioned in the introduction; furthermore, we wish to acquaint with the proposals the personnel managers at the enterprises, giving them detailed information about the studies of electronic computer majors at the technical colleges.

Professional Profile of Graduate Majoring in Electronic Computers

The graduate's professional profile is determined by his theoretical and applied knowledge, gained from studying mathematics, computer science, physics, the principles of electrical engineering, microelectronic technologies, electronics and optoelectronics, automation and microprocessor technology, electronic measurement, and transmission of information. His profile is characterized by knowledge of the following fields:

- The methods of analyzing, designing, modeling and verifying digital systems, at the systems, logic and electronic levels;

- The architecture and operation of computer systems, including microcomputer, parallel and distributed systems;

- Reliability, diagnostics and test generation, at the software, systems, logic and electronic levels;

- The methods and tools for the computer-aided design of computer systems;

- Special computer architectures from the viewpoint of concepts and applications (for the processing and recognition of signals, for the interpretation of high-level programming languages, for the management of databases and knowledge bases, etc.);

- Programming in machine-oriented languages, microprogramming, and microprogrammed emulation;

- Programming methods;

- Development of programming tools and systems, including the design of languages, translators, and operating systems;

- Computer graphics;

- Artificial intelligence methods and tools; and

- Measuring and rating the performance of computer hardware and software.

Particularly the following career opportunities are open to the graduate:

- As a designer or design engineer of computer systems, at organizations engaged in the research, development, production and applications of computer systems;

- As a systems engineer in the field of configuring, installing and operating computers, including peripherals (from the viewpoint of the hardware and software);

- As an engineer specializing in conceptualizing, developing and maintaining equipment for computer-aided design, engineering and manufacturing (CAD, CAE, CAM), including the computer-aided design of VLSI circuits;

- As an engineer specializing in creating and operating computer graphics systems;

- As a programmer specializing in the writing, development and maintenance of systems software for conventional, parallel and distributed computer systems (operating systems and other systems software), and of special software systems (database systems, systems for the representation of knowledge, expert systems, computer-aided programming systems, etc.);

- As the computer-technology specialist on a team for designing, developing and operating the various levels of automated control or management systems (ranging from the automated control of technological workstations to the automated management of an enterprise), and robotic systems.

The graduate is professionally qualified to teach programming and computer technology in secondary schools, secondary vocational schools and at the college level, and to train cadres for the widespread application of electronics in the national economy.

Comparison of Graduates' Profiles

From the viewpoint of computer technology, the relationship between the graduate majoring in electronic computers, and the graduate majoring respectively in engineering cybernetics or microelectronics at the electrical engineering faculties of a technical college, and in computer science at a university, can be summed up as follows:

The graduates majoring in engineering cybernetics (in every narrower specialization) are trained to actively apply computer technology, primarily to the task of controlling plants or processes diverse in their nature and essence. The graduates majoring in electronic computers mainly provide and maintain the hardware and software. Furthermore, on the teams that are developing systems to control industrial and other processes, they are the computer-systems specialists who solve the systems problems in conjunction with the nature of the specific application (for example, the implementation of special programming languages, operating systems, etc.).

The graduates majoring in microelectronics are trained primarily in the physical principles and procedures for designing and fabricating microelectronic structures, using computer-aided design tools. The graduates majoring in electronic computers join the design teams as computer-technology specialists who devise the design methods, primarily at the systems and circuit-logic levels, and develop the equipment for the computer-aided design of integrated circuits (VLSI circuit compilers, systems for automatic checking and test generation, for example), at every level of designing.

As the users of integrated circuits that are the building blocks of computer systems, the graduates majoring in electronic computers send feedback to microelectronics, in the form of not only new systems designs, but also of ever-stricter requirements regarding the properties (speed, reliability, etc.) of the systems.

The graduates majoring in computer science gain generalized knowledge of computer-controlled plants or processes and computer systems; and they master the methods of proposing and developing general, mathematically formulated and proven, theoretical principles on which information processing systems are based. In the areas of computer applications, they make use of their extensive mathematical knowledge, with emphasis mainly on computer software.

Brief Syllabi of the Special Courses

(Asterisks indicate elective courses)

Mathematical Analysis I, II: Functions of real variables, limit, continuity, derivation and differential, mean value theorems, Taylor's series, limits, sequences, exponential

series of real and complex numbers, expansions of elementary functions, integral calculus, and linear differential equations. Ordinary differential equations, existence of a solution, line and surface integrals, Fourier series, expanding a function in a Fourier series, principles of analysis in a complex field, Laplace transforms, Fourier's integral, and z-tranforms.

Linear Algebra: Polynomials, rational functions, matrices, determinants, solution of systems of linear equations, vector spaces, vector algebra (in analytic geometry), linear mapping, characteristic vectors and values, linear and quadratic forms (conics, quadrics).

Discrete Mathematics I, II: Propositional and predicate logic, theory, completeness and indisputability, inference, and verification of programs. Relations, operations on relations, properties of relations, equivalence, ordering, and representation of relations. Connectives, types of connective, and Boolean connective. Algebraic structures: concept of algebra, morphism, congruence, and discrete product of algebras. Algebraic structures with one binary operation (groupoid, semigroup, monoid, quasi-group, and group). Algebraic structures with two operations (semicricle, circle, and body). Boolean algebras. Graph theory (nonoriented and oriented graphs, connection, acyclic graphs, circles, characteristic values in graphs, skeletons, trees, and edge-disjoint graphs).

Numerical Methods: Errors in numerical computations, conditional stability of numerical algorithms, iterative methods, solution of algebraic and transcendental equations, interpolation, approximation of functions, numerical integration, and solution of ordinary differential equations.

Probability and Mathematical Statistics: Probability of random events, distribution of random variables, numerical characteristics, and central limit theorem. Random sampling, moments of frequency distribution, estimates, confidence interval, testing of statistical hypotheses, linear regression, and stochastic processes.

Programming I, II: Algorithmic presentation, and programming in high-level language. Survey of computer hardware and software. The writing of extensive programs, more complex algorithms, sorting, and searching. Abstract data as a method of programming. Complexity of algorithms.

Machine-Oriented Languages: Symbolic machine languages, assemblers and their principle of operation. Syntactic and semantic properties of symbolic instructions, pseudoinstructions, and macros. Programming input-output operations in symbolic machine languages, and modes of communication between programs. Algorithmic presentation in symbolic machine languages, and the construction of typical governing structures.

Programming Methods: A survey of programming methods and languages. Specification, and specification languages. Specification and implementation of abstract data types. Synthesis, analysis and testing of algorithms. Problems of searching and sorting. Data files and their implementation.

Computer Science I, II: Concept of grammar, and classification of grammars. Concept of automaton, and classification of automata. Regular languages and regular grammars, finite automata, and regular expressions. Regular translations, regular translation grammars, finite translation automata, and serial representation. Mealy and Moore machines. Petri networks. Context-free grammars, and stack automata. Syntactic analysis. Context-free translations, and translating stack automata. Context-sensitive grammars, and linearly limited automata. Unlimited grammars and Turing interrogation, algorithms, recursive functions, and the complexity of algorithms.

Operating Systems: Computer system aids, architecture of operating systems, control languages, utilities and user interface, file control systems, control of peripherals, and writing drivers.

Translator Fundamentals: Basic concepts and principles for designing translators. Interactive systems, man-machine dialogue. Attribute translation grammars. Lexical analyzer design. Processing of object statements. Translations of typical language constructions. Program optimization. Generation of target program.

Modeling and Simulation: Modeling of queuing systems. Modeling of discrete systems. Modeling of continuous and combined systems. Simulation languages.

Computer Graphics: Computer graphics hardware, geometric principles of computer graphics, software for graphic image systems, computer graphics standards (GKS), and interactive graphic image systems.

Databases: Models of database systems. Specification and inquiry languages. Using database systems.

Physics: Mechanics, oscillations, theory of relativity, statistical physics, kinetic theory of gases, and thermodynamics.

Principles of Electrical Engineering and Optics: Electricity, magnetism, electromagnetic field, waves, electromagnetic waves, wave optics and geometrical optics.

Solid-State Physics: Introduction to quantum physics, wave behavior of particles, principles of quantum mechanics, microparticles, electron shell physics, structure and mechanical properties of materials, thermal properties of materials, band theory of solids, conductivity of metals and semiconductors, physical functions of semiconductor devices, the atomic nucleus.

Network Theory: Classification of electrical networks, topology, description, theorems and principles. Analysis of linear and nonlinear resistance networks. Steady-state harmonic analysis of lag networks, network functions, frequency characteristics. Anharmonic waveforms. Three-phase systems. Transient phenomena in linear networks, and time characteristics. Convolution integral. Two-port networks and homogeneous lines.

Electronic Measurement I: Methods of electronic measurement. Analog and digital measuring instruments. D/A and A/D converters (for users). Oscilloscopes and recorders. Methods of measuring active and passive electrical quantities. Distortions, measuring errors and how to limit them. Measuring of magnetic quantities. Measuring of nonelectrical quantities, and the principles of the appropriate transducers.

Fundamentals of Automation Technology: Range of control problems, basic concepts and definitions. External descriptions of continuous and discrete dynamic systems. Closed-loop system for the automatic control of continuous and discrete technological processes. Implementation of control algorithms. Sensors and actuators.

IC Technologies and Elements: Process of manufacturing integrated circuits (growing single crystals, lithography, diffusion, epitaxy, implantation, etc.). R, L, C, and M elements, diodes, discrete and integrated bipolar and unipolar transistors. Transistor models, parameters (including dynamic parameters) and characteristics. IC structures and technologies (TTL, STTL, IIL, ALS, PMOS. NMOS and CMOS). Optoelectronic devices (LED's, semiconductor lasers, optical fibers, radiation detectors, indicator and display devices, including color monitors). Magnetic materials and elements (magnetic heads, media, Hall probe, and transformer and choke-coil cores). Special (superconducting Josephson) devices.

Electronic Systems I, II: Continuous and discrete signals, and system bandwidth requirements. Passage of pulses through linear passive networks. Transient phenomena in nonlinear lag networks. Generation, shaping and delay of pulses. Layout and characteristics of basic TTL, ECL, IIL, NMOS and CMOS gates. Interconnection for VLSI. Semiconductor memory circuits (RWM, ROM, PROM, EPROM, and EEPROM). Adding nonstandard circuits (level translators, line drivers and receivers, control of indicator devices and displays, optical-fiber interface circuits, control of CRT display). Amplifier stages and transistors, differential amplifier. Feedback systems, stability. RC and LC oscillators. Operational amplifiers, nonlinear and dynamic properties, operational amplifier circuits, function generators and amplifiers, and active filters. Comparators. Phase-lock systems, their circuit design and applications. Reference supply, power supply, and continuous regulators. A/D and D/A converters, analog switches and multiplexers. Special amplifiers (measuring, buffer, sample-and-hold, and pulse amplifiers). Analog data-acquisition system (analog multipliers, dividers, modulators, and their applications).

Logic Systems: Combinatory logic system, its modeling and synthesis, using components ranging from SSI to VLSI. Dynamic imperfections of combinatory circuits. Test methods and design of readily testable circuits. Storage elements of sequential systems, and synthesis of synchronous sequential systems, using components ranging from SSI to VLSI. Logic processors. Synthesis of asynchronous sequential systems.

Digital Computers I, II: Structure of the computer, functions of its units, and their interaction. CPU and its structure, arithmetic unit, data representation, algorithms of arithmetic operations, and slice architecture. Program control, instruction types and formats, CISC and RISC computers. Design and functions of control unit, and microprogramming. Sequential (chained) execution of program and individual operations, vector processors. Tools for describing the functions and structure of digital systems, design automation. Systems architecture. Memory subsystem, hierarchy of memories, cache memory, and principle of virtual memory. Connecting peripherals to the CPU, bus systems, channels, I/O processors. MIMD and SIMD parallel systems, data-stream-controlled computers, and systolic networks. Foreseeable development of computer architecture, and specialized systems.

Digital Computers III: I/O subsystem architecture, and mutual interactions between the processing unit and the I/O equipment. Standard interfaces for connecting peripherals. External memory. Principles of recording, coding, error control, and formats. Diskette, disk, and magnetic tape. Control unit's principles of operation, functions, and standard recording formats. Computer output equipment. Displays, printers, plotters and recorders. Principle of operation, standard interfaces, and functions of control unit. Computer input equipment. Keyboard, touch screen and panel. Graphic input, light pen, mouse, data tablet, and digitizer. Control unit's principle of operation and functions. Equipment for data preparation and acquisition, recording media, coding, error control, and formats. Peripherals of the future.

Project: Independent work by the students under professional guidance, on individually assigned tasks in the field of computer hardware or software.

Data Transmission: Signal theory, information theory, coding, transmission media, discrete signal transmission, and data link.

Distributed Systems: Functional and configurational distribution, lower and upper layers of communication subsystem, and applications layer.

Electronic Measurement II: Methods of implementing digital equipment and of using the basic measuring and testing instruments, universal and single-purpose testers, simulators and analyzers, development tools and their use.

Computer Design: Hierarchic levels of computer modules, their implementation, digital equipment components, design parameters, I/O design documentation, transmission and distortion of signals at interconnections, implementation of short and long lines, timing and synchronization in digital systems, computer's power supply, cooling of computer modules, physical quantities as information carriers, and design of memory modules (including restoration of information).

Computer-Aided Design of Digital Systems: Methods of automated design employed in practice; structural-design, decomposition and iterative algorithms in automated design; application of CAD systems in the selection, layout and interconnection of the modules; CAD systems used in Czechoslovakia; CAD systems for the design of custom and semicustom chips (descriptive language tools and checking the design).

Reliability and Diagnostics: Methods of testing combinatory circuits, D-algorithm. Structural and functional tests, complete test, location test, and fault dictionaries. Methods of testing sequential circuits. Methods and tools of automatic diagnostics. Error-detecting codes and their checkers. Elaboration of methods for designing circuits that can be readily diagnosed. Testing of LSI circuits (memories, PLA's and microprocessors). Reliability. Reliability indices and their computation. Markovian models. Redundancy.

Economics of Computer Systems: Applications of computer systems. General principles and objectives of rating computer performance. Performance-rating methods and tools. Use of models. Methods for rating the performance of selected computer systems. Optimal use of computers under automated management systems. Conditions for the efficient use of computers at computer centers.

Special Computer Architectures: Fault-tolerant computer structures. Parallel systems. Flow and vector processing. Structures and algorithms of matrix processors. Stream-controlled computers and VLSI processors. Transputers, RISC architectures, database processors, systolic structures, signal processors, single-chip computers, and coprocessors.

Modern Computer Components*: Processing, transmission and recording of optical signals, cryogenic devices and their applications, modern memory elements and media, and bioelectronics.

Computer's Communication With the Environment*: Basic principles and tasks of data acquisition, conversion and transmission. Properties and characteristics of signals as information carriers. Methods of designing and implementing the computer's analog subsystem, basic principles of analog computations and their application. Processing of data in the time and frequency domain, the use of Fourier transforms and z-transforms. Analog processors and their utilization.

Peripherals*: Specialized and promising peripherals at the design level; new generation of peripherals for man-machine communication; I/O subsystems of JSEP [Unified System of Electronic Computers] and SMEP [System of Small Electronic Computers] at the implementation level; design of standard peripheral controllers; design of the I/O subsystem of microcontrollers, using integrated microcomputer modules; reading, representation and transmission of technological data; interface and control of the standard buses of measuring and control systems.

Local Area Networks*: Classification of LAN's, topology and methods of approach. Hardware. Interconnection of LAN's. LAN performance and reliability. IEEE Standard 802.

Software Engineering*: Methods of designing, implementing and using extensive software systems. Modular programming and its use in creating abstract data types. Methods of structured programming. Software-debugging methods and tools. Organization of programming.

Programming Language Structures*: Common features of high-level programming languages; data units and types of language. Governing language structures. Methods of implementing program structures. Tools for describing parallel processes. Nonprocedural programming languages.

Construction of Translators*: Translation theory; lexical analyzer elements; theory of LL and LR languages, and syntactic analyzer elements; semantics of programming languages; automation of the implementation of semantics; parallel language translators; semantics of the translator's control.

Construction of Operating Systems*: Control of processes and processors, parallel processes, memory allocation, implementation of nucleus, operating-system protection, distributed operating systems, maintenance of operating systems.

Computer Science 3*: Computability and computational complexity. Algorithmic equivalence of various programming-language features, Church's thesis, undecidability of the problem of stopping, relationship between partially recursive functions and the programming language tools, Godel numbering, recursively enumerable sets, lamda calculus, abstract complexity theory.

Database Design*: Definition of concepts: information system, expert system, and knowledge-based system. Design of the database schema, approaches to describing behavior, conceptual modeling tools, implementation methods, computer-aided database design.

Principles of Artificial Intelligence*: Basic AI concepts. Representation of knowledge; general solution of problems. Predicate logic; automatic proof; resolution principle. PROLOG and LISP languages (fundamentals and use). AI applications (briefly): expert systems, natural language processing, pattern recognition, learning, and cognitive robots.

Artificial Intelligence*: AI methods (heuristic programming, production systems). Representation of knowledge (declarative and procedural knowledge, inference, semantic networks, skeletons). Natural languages (analysis and synthesis). Expert systems (design, use, and diagnostics). Cognitive processes (learning, planning).

The courses not listed here are core subjects common to all majors of the electrical engineering faculties.

[Box, p 289]

New Electronic Components

The worldwide development of electrical engineering produces each year hundreds of new electronic components that permit completely novel ways of designing electronic instruments, equipment, control systems, etc. The Czechoslovak electrical engineering industry, too, must develop new types of electronic devices that will contribute toward implementing the program for the widespread use of electronics in the Czechoslovak economy. By 1990, for example, Tesla Electronic Circuits and Components, in Roznov, must increase its commodity output 2.5-fold over 1985. The production assortment for the 8th Five-Year Plan comprises nearly 1,800 component types. Although this assortment is a reliable supply base for solving many of the problems of final electronic products, it is able to supply neither the entire demand for electronic components nor its growth. Qualitative changes are expected from the implementation of the CEMA countries' Complex R & D Program that assigns Czechoslovakia the task of supplying also the other member nations with technologically demanding integrated circuits, in exchange for components in a range of other classes and types. The primary purpose of this cooperation is to allocate the production programs so as to achieve economies of scale and improve product quality.

The new components being introduced in the market during the five-year period include, for example, new types of custom chips from Tesla in Roznov, an advanced generation of 12-bit converters, and split-screen displays. Tesla in Piestany will assign to production a single-chip microcomputer with resident EPROM memory, and modern types of RAM; an outstanding technical novelty will be a CCD color camera. Tesla in Lanskroun will come out with a new series of electrolytic capacitors, including capacitors for industrial applications. Tesla in Hradec Kralove has assigned to production monolithic capacitors of modified design, and ceramic packaging for integrated circuits. The other Tesla enterprises are also coming out with new products.

PC Use, Production

24020005 Prague PTT REVUE in Slovak No 4, 1987 pp 120-123

[Article by Engr Roman Ondrus, URcS, Bratislava: "New Trends in the Development of Personal Computers"]

[Text] Computer-based automation is radically changing many aspects of society's life. Experts generally agree that, in the immediate future, personal computers will also have an ever-greater impact in such areas as office automation, word processing, filing of personal notes and records, accounting, budgeting, etc.

The CEMA countries Complex R & D Program through the year 2000 confirms that the personal computer will be an outstanding tool of the future. The program's section entitled Widespread Use of Electronics in the National Economy sets as one of its primary tasks the development of mass-market computers for extensive use—of personal computers with abundant software, to meet the needs of the national economy's branches and R & D organizations, as well as for home use.

This article offers a brief survey of the development of personal computers, and basic information on the prospects and possibilities of their application in today's world.

Wide Range of Personal Computer Applications

The first computers that appeared over 40 years ago were too bulky and slow, and had a large number of electron tubes and mechanical parts. They were neither economical nor reliable, and did not resemble at all the plastic housings of today's microcomputers. Yet their appearance was a breakthrough and penetration into a new sphere of science and social practice.

The computers' potential long remained hidden behind the walls of computer centers, and access to it was effectively guarded by the professionals running the computers—the programmers and systems analysts. The computers' impact was merely indirect, and not so significant as had been predicted in the 1950's. But the arrival of microcomputers of various types, intended for diverse applications, successfully broke this monopoly. (Personal computers first appeared on the world market in early 1975, and ten years later their number increased to more than 20 million units.)

A delegation of experts from the USSR Academy of Sciences visited the United States last year, to acquaint themselves with personal computers, their installation and practical applications. Members of the delegation found personal computers in operation even in many kindergartens and elementary schools, as well as in stores, banks, at transport and communications facilities, on university campuses and in business offices. The delegation's conclusions and impressions from this visit can be summed up as follows:

- The personal computer is a "commodity" that is widely used and much in demand.

- Computers may no longer be regarded solely as production tools. The large assortment of personal computers, together with peripherals and software, is intended for use not only at work but in everyday life as well. (Prices at the low end of the computer market start around 250 to 300 dollars a unit. That is the price, e.g., of a Commodore 64 computer, including printer and word-processing software.)

- The process of the computer's transformation into a consumer good affects the individual's social relations and awareness. By the end of the present century, the computer will have inevitably become a part of his world.

Basic Characteristics

One of the various criteria on which the classification of personal computers can be based is their intended use. Accordingly, we distinguish home computers from professional computers used at work (in offices, plants, etc.).

In the following we will consider the class of professional computers.

According to one of the many definitions to be found in the technical literature, the personal computer (PC and home computer are respectively a commonly used abbreviation and designation) is a simple computer, usually built with a single-chip microprocessor, and used mostly by one person and possibly by several persons. Fig. 1 [not reproduced] presents the general block diagram of a personal computer.

A PC always has an 8- or 16-bit central processing unit, between 4Kb and 512Kb of memory, and a keyboard similar to that of a typewriter. Depending on its technical level, performance and price, a PC also has the following units:

- A monochrome or color monitor to display alphanumeric information (usually 16 to 25 lines, and between 32 and 80 characters per line), and often also special characters with which it is possible to draw simple figures. The more expensive computer may have a graphics CRT, usually with about 70,000 pixels, possibly in color. The more simple computer may use a TV screen for display, by directly connecting the computer's output to the antenna input terminal on the TV set.

- External memory, usually one or two disk drives (floppy diskettes). The most expensive computers may have a hard disk with a capacity of about 10Mb. Home computers may use a commercial cassette recorder for their output.

- A printer (or an output interface for connecting a printer).

- An internal modem.

In accordance with its intended use, a PC may also be equipped with other devices. For example, with a control unit for switching domestic appliances, a keyboard for sound generation, joysticks (for computer games), etc.

Software

The software is first of all the "system software" (the two types of operating system for more advanced PC's worldwide are PC/M and MS-DOS) that comprises the supervisory control (or monitor) program—either in ROM or on a magnetic medium—and programming language translators. Some user programs—calendar, address book and telephone directory, for example—are likewise stored in ROM. All the computers come with interpreter BASIC. Furthermore, many applications programs are available on cassettes or diskettes.

Office Automation Software

We know from the practice of using computers that they are very difficult to use without suitable software. This holds increasingly true for personal computers. It can even be said that a PC without the appropriate system software and basic applications programs is practically worthless.

After a careful analysis of office routines, standard programs have been written to solve them as efficiently as possible, with the help of personal computers. Four classes of such applications programs have become established in recent years: word processing, database management, spreadsheets, and graphics.

Word Processing: All the available word-processing programs offer features such as, for example: drafting letters made up of standard paragraphs and phrases stored in the computer; printout of form letters with name and address changes, thesauri and glossaries (for writers and managers); deletion and moving text; reformatting; updating of records, etc.

Database Managament: Often known also as electronic notebook or relational database system. The available programs permit quick search, retrieval and updating of data. Today, in the computer age, there still exists a huge

volume of manually maintained card files, for example: personnel files, inventory cards, stockroom cards, library files, medical history files, etc. The use of personal computers merely to maintain such records would be very cost-effective.

Spreadsheets: The available programs display on the screen a table (two-dimensional matrix), in which the user can enter alphanumeric data or formulae as matrix elements. The spreadsheet programs can be used for invoicing, ordering, scheduling, audit trails, budgeting, following reducing diets, etc.

Graphics: The available program "packages" are able to present numerical data in the form of circular, two- or three-dimensional charts and graphs.

Integrated Software: Applications programs of all four classes (word processing, database management, spreadsheets, and graphics), together with a communications program, can be combined into a so-called integrated software package, the most modern software for office PC's. With a locally oriented computer configuration (e.g., a desktop computer, PC, and office computer) it is then possible to form a problem-oriented local area network (see Fig. 2 [not reproduced]).

Personal Computers Available in Czechoslovakia

The professional PC's that can be purchased through the Kancelarske stroje and Datasystem special-purpose concern organizations, or through the Kovo Foreign-Trade Enterprise, may be divided into two broad classes: PC's of domestic make, and imports.

Domestic PC's

In this class we may include the so-called versions of the desktop and office computers, which are essentially their more powerful successors that are often used specifically for business adminstration, engineering, medical, economic and other professional activities.

The development of personal computers began in Czechoslovakia in 1982. Several 8-bit personal computers were developed at that time, and they can be divided essentially into two groups:

- Less powerful, and therefore also less expensive, portable PC's without their own monitor and external memory, but with provisions to attach a TV screen or cassette recorder. We may include in this group the SMEP 01, the PMD 85, and the IQ 150 personal computers;

- More powerful, but more expensive, desktop PC's equipped with their own (built-in) monitor. An example is the SMEP 03 personal computer, with a maximum of 60Kb RAM, a keyboard, and two 130-mm disk drives.

The mentioned computers' areas of application are as follows:

- Computations: household budgets, insurance, and loans;

- Word processing: correspondence, and ordering;

- Instruction: languages, and various other subjects;

- Data acquisition: from measuring, diagnostic and information systems, and the transfer of data to a larger computer;

- Control: heating, air conditioning, lighting, alarm system, and telephone answering machine.

Lately the Czechoslovak computer industry—pursuant to the Complex R & D Program, and in response to the need to install a large number of computers but without the expenditure of foreign exchange—has developed and is producing several types of desktop PC's and office computers that have a wide range of applications. For example, the Research Institute of Computer Technology, in Zilina, has developed a "family" of personal computers that belong in the System of Small Computers and are designated as the PP-01 through PP-06. In this brief survey we are including, for comparison, merely the first and the last models in this "family."

PP-01

The PP-01 personal computer is an 8-bit microcomputer with 64Kb of main memory, an 8080 microprocessor, and provisions for color graphics display. The PP-01 is designed to use low-cost and available peripherals: a TV set for display, and a tape recorder as external memory to store the written programs. The computer is intended for the widest possible range of users, especially for applications in which mini- or microcomputers would not be cost-effective. The PP-01 can be used in productive as well as nonproductive spheres, in offices, services, health care, agriculture, and scientific-research institutions. Simple programming in BASIC makes the PP-01 suitable for use in secondary schools and higher education. Its flexibility permits various configurations and systems: to manage small projects, orders, the supply of materials and equipment; to form intelligent terminals; and to control laboratory tests and smaller technological processes or plants. This universality stems from the feasibility of using peripherals such as the SM 50/40.1 system's modules that have an Intel 41 bus. Full-scale series production of this personal computer at the ZVT in Banska Bystrica will begin in 1987. Its price has been set tentaviely at 20,600 korunas.

PP-06

The PP-06 professional personal computer is a powerful model that ranks at the peak of the PC family's hierarchy in the SMEP system.

The PP-06 has been developed in an effort to increase the performance over that of the SMEP system's previous PC's. As a result of this development, the memory capacity of this model is much larger, it is able to access a central computer's extensive databases, and it has its own software, including a new operating system, PP-DOS.

The CPU of this model is a 16-bit 8088 microprocessor, with an added 8087 numeric data coprocessor that makes for high operating speed. This speed—together with the large memory capacity, external memory, peripherals, expansion modules and software—predetermines the computer's application in the following areas: scientific, engineering, and economic computations; design; intelligent terminals in computer networks; control of measuring stations, and of laboratory and medical equipment; office automation; and the acquisition and preprocessing of data.

Production of the PP-06 personal computer at the ZVT in Banska Bystrica will begin in 1987, with the so-called PP-06-A version. As of 1989, the production is planned of the PP-06-B version with a 5.25-inch hard disk, and of the PP-06-C version with graphics and a high-resolution (1024 by 1024 pixels) color monitor. Both these versions are now in the stage of development. The tentative prices are 99,500 korunas for the PP-06-A, 105,000 korunas for the PP-06-B, and 150,000 korunas for the PP-06-C.

An "interesting" feature of the PP-06 is its software compatibility with the IBM PC.

The TEXT 01 office microcomputer is another product that has been developed and is now being produced by the Czechoslovak computer industry, pursuant to the requirements and conclusions of the Complex R & D Program, and in response to the need of installing a large number of computers for widespread use, but without the expenditure of foreign exchange.

TEXT 01

This is essentially an office microcomputer, designated in the international nomenclature as the SM 6915.

The TEXT 01 system is user-friendly, and its operation requires neither a knowledge of programming nor computer experience. It is intended primarily for the storage and editing of text, the composition and required layout of text files, the copying of text, etc. In addition to word-processing programs, the TEXT 01 is also able to run the data-processing software of the SM 50/40 microcomputer. The system's hub is an 8-bit microprocessor, to which a keyboard, monitor, dual disk drive, and printer are connected. The central processing unit's electronic circuits are mounted on six standard SMEP cards in a common card cage. TEXT 01 comes with OS MIKROS, a serial-programming, disk-oriented operating system.

The TEXT 01 system functions as a word processor but also has some functions of office minicomputers. It is manufactured by Aritma in Prague, and sold by the two special-purpose concern organizations: Kancelarske stroje in the CSR, and Datasystem in the SSR.

Other products of the Czechoslovak computer industry that can be included in the groups of desktop and office microcomputers (after supplying them with applications programs) are systems SM 50/40 and SM 50/50.

Foreign Personal Computers

Within this class, which includes also tabletop and office models, we will briefly review only some products that are being supplied to our market through the special-purpose concern organizations Datasystem and Kancelarske stroje, the Kovo Foreign-Trade Enterprise, and perhaps through the agents of such corporations as IBM, Hewlett Packard, Olivetti, etc.

Robtoron 1715

The Robotron 1715 is a flexible tabletop system whose multipurpose hardware modularity permits the system's use in all areas of economic life, particularly in industry, transport, warehousing, services, banking, ministries and offices. The equipment can be used to good effect outside the economic sphere as well: for example, in research institutes and education. Processing is automatic to a large extent. Hence the processing time is substantially reduced, while the information content of the obtained results is higher.

Robotron Office Computers of the A 5100 Series

The series comprises models 5110, 5120 and 5130. Model 5100 [as published] is a simple office computer developed from an invoicing automaton. The programs can be stored in ROM or PROM. Models 5120 and 5130 have more extensive capabilities that the 5110 (larger configuration, and more software).

Model 5120 is a desktop version, and the 5130 is a compact design. These models are already operating in Czechoslovakia. The demand for them is ever greater, because they can be used as stand-alone computers at small enterprises.

IBM Personal Computers

As the largest and most important manufacturer of computers and automation equipment, IBM Corporation is of course also in the PC market and is offering its products in Czechoslovakia as well. This applies particularly to the typical configurations IBM PC1, PC-XT, PC-AT and PC-AT3.

The PC-XT is a personal computer with sufficient performance parameters and systems support for bulk data processing in, for example, accounting, payroll preparation, inventory control, sales, services, trade, etc. Its techincal parameters are as follows:

- A 16-bit Intel 8088 microprocessor;

- 256Kb of main memory, expandable to 640Kb;

- A 10Mb hard disk;

- A 16-color monitor; and

- A printer for standard and special characters.

The DOS operating system, in combination with various special-purpose applications (word processing, network analysis, etc.) and the feasibility of using the programming languages developed for mainframes (e.g., COBOL, PASCAL, APL, etc.), indicates this personal computer's exceptionally wide range of applications.

In the Czechoslovak market, products of the IBM PC series—in the same way as other computers—are subject to licensing. On the basis of the experience to date, it can be said that it takes about 3 months to obtain a licensing agreement for up to sixteen IBM PC1's or PC-XT's, or for one IBM PC-AT, per user (off-line). The licensing of a larger number of IBM PC's will take longer, about 6 to 7 months.

Anyone seriously interested in specific IBM PC's should contact the Kanselarske stroje or Datasystem special-purpose concern organization, or the Kovo Foreign-Trade Enterprise.

Hewlett Packard Personal Computers

Hewlett Packard is likewise offering some models of its line of personal computers in the Czechoslovak market. This applies particularly to the HP 150 A, the technical parameters of which are as follows:

- A 16-bit Intel 8088 microprocessor;

- 256Kb of main memory;

- 3.5-inch double-sided floppy with a capacity of 710Kb; and

- An HP 2225AB printer, European version.

The entire system costs about 5,500 U.S. dollars (1986 prices), and licensing for one system takes 4 weeks. Its areas of application are primarily accounting, payroll preparation, services, trade, word processing, etc. Anyone seriously interested should proceed in the same manner as in the case of computers in the IBM series.

Olivetti Personal Computers

Italy's Olivetti is offering one of its latest models, the PC M 24 SP, in the Czechoslovak market. The Olivetti computer is fully compatible with the IBM computers, but is 1.8 times faster and costs less. In 1986, the price of an M 24 SP system (a 360Kb disk drive, a 20Mb hard disk, 640Kb of RAM, keyboard, and a monitor with a resolution of 640 by 640 pixels) was 4,290 U.S. dollars.

Rank Xerox Personal Computers

Rank Xerox is active in the world market primarily with its copiers, but has a solid position also in computers and control equipment. In the Czechoslovak market it is offering at present two personal computers: the Rank Xerox PC AT, and the Rank Xerox PC Turbo. These personal computers are respectively compatible with the IBM PC AT and the IBM PC-XT. They run under MS DOS. The user can choose from a wide range of programming languages and applications programs (databases, spreadsheets, etc.).

Conclusion

In this article we have attempted to call attention to the basic areas affected by the advent of microcomputers and personal computers. Typical of the present stage of the personal computers' introduction is that this technology is being installed primarily in those areas where the risk of failure is minimal and possible negative effects are the least likely. The rising performance paramters and improving utility characteristics of personal computers, in combination with the wider access to them, bring about a qualitative improvement, a new technological level, in the use of computers in management. New possibilities are opening, and the range of applications is widening, for the further perfection of management.

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SCIENCE & TECHNOLOGY POLICY

Fund Shortage Plagues Recipients of Hungarian Basic Research Awards

25020010 Budapest COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 18, 9 Sep 87 p 2

[Article by Katalin Magos: "OTKA—A Second Time"]

[Text] At the end of July the committee of the National Scientific Research Fund (OTKA) again announced an open competition: for basic research promising outstanding scientific results, linked to the long-range trends of scientific research and corresponding to the international development of science. According to the communique released they will support primarily research serving to discover scientific information, laws, methods and procedures. Entries can be submitted by individuals and research collectives performing successful activity at research institutes, institutions of higher learning, public collections and enterprise research sites.

The announcement of a second OTKA theme competition gave me an idea: Let us look around to see how the researchers who won support just one year ago in the first competition are doing with their work (see COMPUTERWORLD/SZAMITASTECHNIKA, No 3, 1986). Well—this being basic research—perhaps the inquiry was too early, the first sums reached the researchers only this year, so instead of reports on results achieved thus far we could only collect often bitter experiences. Because opinions today are quite divided about the new competition system adopted with general enthusiasm in the beginning.

University researchers complain that not a year has yet gone by and already the total support sum for the 5 years has been cut by 20 percent. They and others say that they have received none or only a very small part of the investment costs portion, and the same applies to the foreign exchange. There was one who received so far one hundred (!) dollars as the "time proportional part", with which of course one cannot start anything, as is true for others with fractional amounts of money. Of course there are those who have no problems, perhaps they are in the majority—those who asked support only for investment costs, who work in a large institute, those who are well known researchers and collected the necessary money from various types of competitions.... And, of course, there are also those who complain unjustly, because they do not clearly understand the game rules for the OTKA competition, did not take the trouble to read the contract before they signed. Because there it is, among other things, in a nice, big table—the annual schedule for the support sum. So it is unjust to complain that they did know the scheduling of the support; but it is just to ask why they get the most—we are talking about basic research!—in the last year, just prior to reporting on the results. Many, unfortunately, do not know whom they signed the contract with. The contract partner is not the OTKA committee or office but rather their chief authority, the Academy or the appropriate ministry. The chief authorities participating in the OTKA committee put the money in a "common hat" and the money to be handed out is collected quarterly, and then transferred over the years in accordance with the schedule prepared together with the contest decision. They say that those who won support have in hand valid paper for the promised sum and they could ask their institutions for an advance on the money. But practice will hardly develop from this theoretical possibility given the bad financial status of the research sites. It was emphasized even in the first report of the OTKA committee (March 1987) that a problem is being caused by the fact that in places the OTKA is being forced to supplement basic institutional supply—because of the very great backwardness of support for basic research—in contrast to the principle announced. So to a certain extent the basic principles suffered injury in the course of realization. One can read in the same report that there are only a few young researchers among the theme leaders, there were disproportionately few provincial entries, the priority of jointly cultivated themes was not realized adequately, and the separation of operational costs and investment funds from one another is objectionable—although this also depended on the uncertainty of investment and foreign exchange funds—because conducting the contest fell on existing organizations and too great a burden fell on participants from Academy bodies and the ministries; the process of signing the contracts proved especially critical and took twice the time planned.

This self-critical tone is to be praised, as is the fact that the OTKA was developed further accordingly for the second theme competition just announced; as a new form of scientific guidance and financing it is, in the unanimous opinion of various experts, an open, modern and democratic system; after overcoming the initial uncertainties it can bring a qualitative improvement in support for basic research.

This opinion is also reflected by the critical but well intended observations which winning researchers write about the competition system and which can be read regularly in the MTA [Hungarian Academy of Sciences] journal MAGYAR TUDOMANY. All of them reflect optimism—as well as a discussion of errors. "We certainly must maintain the competition system. Naturally there will be a need for minor corrections, for no one can make something perfect in advance. But the slogan for the corrections should be 'videant consules' lest the initial, truly bright aspirations disappear in a boring and uniformized grayness," wrote, for example, Mihaly Sajgo, doctor of biological science and university professor (Agricultural Sciences University, Godollo), in an

article titled "Joy and Bitterness—The Subjective Notes of an OTKA Winner" in the May 1987 issue of the journal.

It is put this way in the first and last points of notes recently sent to the editors of MAGYAR TUDOMANY by Academician Tibor Vamos: "Is the competition a good thing? Factually it is good, for it is used throughout the world, even by countries which have more than we. The reason is quite simple. There was a belief here earlier that everything could be calculated precisely, planned in advance, and the officials exercising power, who were appointed to it by a yet higher power on the basis of the infinite wisdom of the highest power and a special and perfectly reliable, clairvoyant science at their disposal, could say most wisely what should be studied, how, for how much, with what time limit and what result. This had become one of the fixed components of a scientific plan as a people's economic plan. Since this faith rather failed—though far from completely in its consequences—the possibility arose of exploiting the experiences of those others mentioned, who have more, and introducing a form of various free initiatives. This is the competition." "...So, finally, did the first round go well? Probably not entirely. This also must be learned, like everything which in the past had to be and in the future will have to be learned. Freedom has a price, not only that it must be won, there is also the price of long tuition—which those mentioned, who have more than we, mastered over many generations—of risk and suffering. All this is not commensurable with the suffering and price which the closed, autocratic systems bring. The competition is the opening of a little door among the many essential openings of gates."

So what have we learned from the first round, that is, what can we read from the second theme competition now, in the days of its announcement? Perhaps few will note at first that this time one can ask for support between 1988 and 1991. We are seeing the reality of what was said by Istvan Lang, first secretary of the MTA and chairman of the OTKA committee, at this year's general meeting of the Academy: "For the first time we will step over the walls of two 5-year plans, previously believed to be virtually unbreakable." And this itself is a great feat of arms. The OTKA committee is also encouraging participation by researchers younger than 35 years, if they enter with a promising theme and an original idea.

And now the less happy news—contestants can ask the fund for support for a maximum of four years, exclusively for costs (that is, there is no possibility for instrument investment).

It is also new that a total of 400 million forints can be spent on the present competition, the forms have become simpler, and researchers who entered last year but did not win support can fill these out asking that their entries be judged again. Naturally they can also enter with a new theme.

Those who, after all this, have the strength and spirit to get support for basic scientific research in this way can submit entries to the OTKA office (where forms can also be obtained) by 30 September. Contestants will receive a decision by 29 February 1988 concering the support funds to be extended, beginning in the second half of next year.

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AEROSPACE, CIVIL AVIATION

Satellite Project Under Development

36990009 Buenos Aires TELAM in Spanish 1633 GMT 15 Nov 87

[Text] Argentine Air Force Chief of Staff Brigadier Ernesto Crespo has revealed that Argentina is working on the construction of a scientific and communications satellite which will be put in orbit by the end of 1990 or in early 1991. It is also working on the development of a launching vector for these space vehicles [vectors de lanzamiento de estos vehiculos espaciales]. [sentence as received].

Crespo said that the project, called "SAC-1," is being developed with U.S. help, and hinted that the program would be carried out completely in the Argentine Air Force complex of Falda del Carmen.

Crespo also said that the Economy Ministry has already issued approval for the Air Force to form a joint company with a Spanish firm, which will take charge of the weapons factory near the Cordoba materiel area.

According to the Cordoba daily LA VOZ DEL INTERIOR, Crespo said that we have made considerable progress with the airplane, weapon, and satellite vehicle companies, and we must continue to improve them by acquiring technology. He also said that this integration does not mean that we are selling the country, because the government will make the final decisions once the company is formed. This means that national patrimony is assured.

Crespo reported that the president will probably sign the decree regarding the linking of the Argentine Aerospace Material Company [Fabrica Argentina de Materiales Aeroespaciales—FAMA] with the Aeritalia company in December, before traveling to Italy.

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END